THE ENGINEERING CONSTRUCTION WEEKLY

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· ENGINEERING NEWS-RECORD ·

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Vol. 120 *APRIL 28, 1938* No. 17

THIS WEEK AND NEXT

THREE YEARS AGO this July the old Ferry St. bridge in Binghamton, N. Y., was washed away in an unprecedented flood. As the bridge was a main link between two important sections of the city, construction of a new crossing began without delay, so that now Binghamton has a bridge that is designed to withstand an overtopping flood. More direct traffic connection is another feature, resulting from a realinement.

Arthur Newell Talbot was honored last week when the laboratory in which he has done a great amount of his engineering research at the University of Illinois was renamed for him. A brief outline of his professional career to date is on page 618.

Coarse materials do not exert a uniform lateral pressure on walls, due to the interlocking action of the individual units of material, according to J. R. McCalmont, who describes a method he has used for measuring these pressures in cribs and bins.

Following a discussion of the small, densely populated state's highway problems two weeks ago, W. O. Whipps of the Montana Highway Commission, tells how his organization provides a large, sparsely populated state with safe, fast roads at small unit cost.

Sounds that are heard deep in California's earthquake faults are being studied to discover whether they bear some relation to seismic movement. Lieut. Wm. D. Patterson describes methods and equipment developed in this unusual work.

NEXT WEEK—Out of war-torn China, Oliver Todd, an engineer of long experience in the ways of that country, writes of the effect of the war on engineers and the works in which they are interested.

		PAGE
The Week's Events		601, 631
Reader Comment		608
Editorials		610
Pictures in the News		612
Flood-Proof Bridge for Binghamton *(Reinforced concrete construction. Floods. Traffic engineering)*	A. Burton Cohen	613
Arthur N. Talbot Honored *(Engineering research. Education)*		618
Measuring Bin Wall Pressures *(Testing. Timber construction)*	J. R. McCalmont	619
Safe Fast Roads at Small Costs *(Highway design, administration and finance)*	W. O. Whipps	621
From Field and Office		624
Fault Noise Studied *(Seismic studies)*	Wm. D. Patterson	626
Book Notes and Reviews		628
Unit Prices	*Adv. page*	12
New Aids to the Constructor	*Adv. page*	16
Construction Reports	*Adv. page*	35

The cover picture shows one of Montana's scenic mountain roads. W. O. Whipps tells the story of Montana's highways on page 621.

Number of copies of this issue printed: 33,072

Here you can actually See The Permanency of Concrete Markers

This 12 inch Atlas White traffic marker on Fore River Bridge between Quincy and Weymouth was built for the Massachusetts State Highway Department by V. Barletta Co., general contractor, Boston.

Shown in this unretouched photograph are two kinds of traffic markers—the permanent concrete kind and the kind that is painted on. You have to look closely to see the latter at all.

See how vivid and clean cut that permanent center marker is. It is made of Atlas White portland cement and Chelmsford white granite aggregate, bonded to the concrete base. This marker will last as long as the pavement lasts. It will never have to be painted, replaced or repaired.

Many highway and safety officials have figured out that in the long run they are money ahead by switching from paint to permanency. They find that permanent markers pay for themselves over a period of years. And from then on they continue to save, each year, the maintenance expense which temporary markers require. Universal Atlas Cement Co. (United States Steel Corporation Subsidiary), 208 South La Salle Street, Chicago.

M-20

USS

ATLAS WHITE PORTLAND CEMENT
FOR TRAFFIC MARKERS

THE WEEK'S EVENTS

Colorado-New Mexico Compact Upheld

Division of water between states by compact supersedes private water rights

The compact between the states of New Mexico and Colorado for the apportionment of the waters of La Plata River was upheld by the U. S. Supreme Court on March 25. The provisions of the compact take precedence over the rights of a private appropriator in Colorado, the court held, reversing a decision of the Colorado Supreme Court.

The La Plata compact, approved by the states in 1923 and given consent by Congress in 1925, provides, essentially, that at times of low flow the waters of La Plata should be divided equally between Colorado and New Mexico.

The La Plata River and Cherry Creek Ditch Co., the Colorado corporation which originally brought the suit, was held entitled in 1898 to divert 39¼ cu.ft. of water per second subject to prior appropriation of 19 sec.-ft. In June, 1928, the entire flow of the river was 57 sec.-ft. The ditch company contends that it was then entitled to the full flow except for the prior 19 sec.-ft. The state engineer, however, in accordance with the terms of the compact, delivered water to the state of New Mexico. The Colorado Supreme Court found in favor of the ditch company. That court held that the compact was invalid in that it disposed of the rights of Colorado water appropriators without opportunity for hearing or compensation and also because it was not based on an actual adjudication of the respective rights of the states but on "a mere compromise of presumably conflicting claims."

State court reversed

The U. S. Supreme Court, reversing the state court, held, first, that since the river flows between the two states, it must be equitably apportioned between them. Hence the state of Colorado in 1898 could not confer on the ditch company rights in excess of the state's fair share of the river.

The fact that no judicial or quasi-judicial allocation of the waters of the river was made in drawing up the compact was held by the court to be immaterial. The interstate compact, the court pointed out, historically derives from and is similar in nature to the treaty making power of sovereign nations. "Resort to the judicial remedy is never essential to the adjustment of interstate controversies, unless the states are unable to agree upon the terms of the compact, or Congress refuses its consent."

"Whether the apportionment of the

Continued on page 607

Proposed Bill Would Make PWA Permanent

A bill to make the Public Works Administration a permanent agency under the Interior Department and to provide it with $1,000,000,000 for loans and grants, as suggested by the President, was introduced April 25 by Representative Beiter of New York.

The bill proposes to give the agency the following new functions: 1. To construct and repair public facilities for lease. 2. To make recoverable loans for temporary operation of projects. 3. To sell and exchange municipal securities rather than use RFC as a broker, as at present.

MAJOR NEWS

	Page
Interstate Compact Upheld	601
Public Works Bill	601
Wyandotte Dam	601
Wagner Dam Fails	602
FPC Checked by Court	604
Cement Bids Rejected	604
Housing Contracts	605
St. Louis Strike Ends	605
Civil Engineers Meet	606
Gilbertsville Approved	607

Wyandotte Project Approved by WPA

WPA will rebuild collapsed dam; accepts responsibility for design and cost figures

The President has approved a WPA allotment of $1,210,000 for repair of the Wyandotte County Lake dam which collapsed last September while under construction (*ENR*, Sept. 23, 1937, p. 495). Also approved was an allotment of $576,000 for development of a park around the lake created in Marshall Creek by the dam.

"Full responsibility for the cost estimates and for the plans under which the dam will be reconstructed" were accepted by the WPA in a statement issued by F. C. Harrington, assistant administrator and chief engineer of the WPA.

The reconstruction plans follow generally the recommendations of the board of engineers which studied the failure (*ENR*, Feb. 24, 1938, p. 218). WPA, however, has scaled down the cost figures offered by the board, reducing by $664,000 the $1,874,000 estimated as the cost of dam repair and by $200,000 the $776,000 allotted for park development.

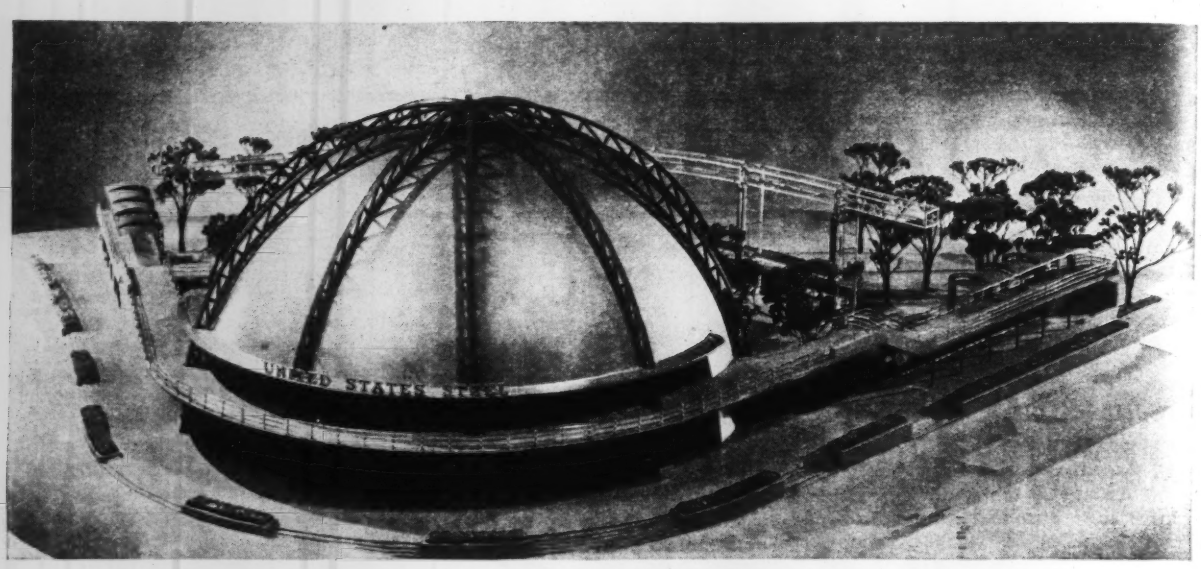
• • •

Test of PWA Power Loans Denied by High Court

The U.S. Supreme Court on April 25 dismissed the appeal of the Tennessee Electric Power Company from a lower court decision vacating an injunction against a PWA loan and grant of $4,000,000 to the city of Chattanooga, Tenn., for the construction of a municipal electric distribution system.

The injunction was vacated following the recent Supreme Court decision upholding the right of the federal government to finance municipal utility plants through PWA in the Alabama Power Co. and Duke Power Co. cases.

This action was contested by the Tennessee Electric Power Co. on the ground that it has a federal franchise for power development at the Hales Bar Dam which provides current for Chattanooga. This difference was sufficient, it was argued, to justify a review by the Supreme Court.



STAINLESS STEEL DOME FOR FAIR BUILDING

INCORPORATING a dome of stainless steel 66 ft. high and 132 ft. in diameter, the building which will house the U. S. steel exhibit at the New York World's Fair of 1939 will be supported by external structural members. Ten steel trusses will rise from a concrete foundation to meet 72 ft. above the ground. Inside the building will be two floors of exhibits, with part of the second floor suspended from the trusses by cables.

Colored concrete will be used for the foundation and for the elevated parapet extending across the face of the structure at the second floor level. The colorful effect will be further emphasized by painting the structural trusses blue.

Shown above is a model of the proposed building.

Dean G. Edwards Named Manhattan Consultant

Dean G. Edwards has been appointed consulting engineer of the borough of Manhattan, New York City, to succeed Jacob S. Langthorn, who will retire from that position on June 1.

Recently consulting engineer of the City Budget Commission, Edwards is a graduate of Harvard and has practiced for more than 30 years in New York City. He was formerly assistant engineer of the Rapid Transit Commission and the Public Service Commission and assistant to the division engineer of the Board of Water Supply on aqueduct construction. He had subway experience in the construction of the Lexington Ave. subway, the Eastern Parkway subway, and the four-tracking of the Brighton Beach line. Edwards was chief engineer of the Civil Works Administration and a deputy administrator of the National Recovery Administration.

Langthorn, who became Manhattan consultant in 1929, graduated from the School of Mines of Columbia University in 1890. After a dozen years of experience with various railroad and rapid transit companies, he became engineer in charge of the boroughs of Brooklyn and Richmond for the New York City Department of Bridges, holding that position for eight years. For ten years he was senior division engineer with the city Board of Water Supply on the construction of Ashokan dam and on aqueduct work. Then, after several years as deputy commissioner of water supply for Brooklyn, he joined the New York contracting firm of George A. Sheddon.

• • •

Irrigation Dam Fails In Washington

The Wagner Dam on Loop Loop creek in Okanogan County, Wash., failed April 19 during high water. The flood wave resulting from the failure nearly destroyed the town of Malott, causing one death and damage estimated at $75,000.

The earth dam was not overtopped but was reported to have failed due to a fault in the concrete spillway. Unusually heavy snows in the watershed of the Loop Loop reservoir had melted rapidly, filling the reservoir to the top of the dam for the first time in its history. Attempts had been under way for several days to strengthen the structure, but these efforts failed.

Wagner Dam is owned by the Pleasant Valley Irrigation District, and the 600-acre-ft. reservoir it created was used for irrigation and stock watering. Built 20 years ago, the dam was a hydraulic fill earth structure about 50 ft. high.

Conservation Ruled Out Of Muskingum Project

Only "very limited" recreation and conservation activities will be carried out by the Muskingum Watershed Conservancy District. The directors of the district announced that their activities would be restricted to flood control after the Ohio State Supreme Court on April 20 had upheld a lower court decision enjoining the district from issuing bonds for construction of a number of small lakes intended for recreation and game conservation.

The district was enjoined from issuing $1,500,000 of bonds, the first part of a proposed $3,000,000 bond issue for the purpose.

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Increased Flood Control Passed by House

The House of Representatives on April 21 approved the non-military appropriation bill of the War Department. The bill carries $113,000,000 for flood control. This is an increase of $50,000,000 over budget estimates and exceeds the recommendation of a $37,000,000 made by the President in his recent message to Congress.

An allotment of $94,300,000 for river and harbor work is an increase over the budget estimate but is less than was appropriated for 1938.

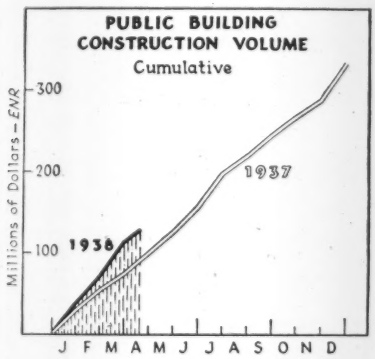
THE CURRENT TREND

This week's news of contract volume and construction cost factors

Public Building Volume Gains

Tops 1937 by 35.5 per cent. Pennsylvania contributes 28 per cent of nation's public building total to date

Public building construction volume totals $129,500,000 for the 16 weeks of 1938, a 35.5 per cent increase over the corresponding period in 1937 as reported by *Engineering News-Record*, but 22 per cent under the high volume for the first 16 weeks of 1936. The average weekly awards for 1938 to date total $8,100,000, compared with an average of $6,400,000 per week for the year 1937, and an average of $8,240,000 per week in 1936 when public building construction reached an all-time high.



This increase is widely distributed geographically, with four of the six territories exceeding the volume of the 3-month period a year ago. New England reports a 54 per cent gain; Middle Atlantic, 88 per cent; South, 120 per cent; and West of Mississippi, 104 per cent. Middle West and Far West are 16 and 38 per cent lower, respectively, than last year.

Awards totalling $31,386,000 from the $65,000,000 institutional building program in Pennsylvania, partially financed by PWA funds, are responsible for a 512 per cent increase in public building awards in that state, compared with the first quarter of 1937. These Pennsylvania awards are 28 per cent of the total public building contracts let in the entire United States during the 3-month period. New York public building volume totals $18,681,000 for the quarter, an increase of 37 per cent over the corresponding period in 1937. Ohio volume on public buildings alone, $5,770,000, is up 202 per cent; Texas volume, $5,330,000, is up 390 per cent. California, with $4,818,000, and Illinois, with $4,053,000, are 66 and 42 per cent lower, respectively, than the volume a year ago.

Loans totalling $53,493,000 have been made by the United States Housing Authority for 10 low-cost housing and slum clearance projects in 9 cities, and contracts for work on these public building projects are expected to be let during the summer. Five of the ten U.S.H.A. loans, made in the past week, total $36,657,000. They include $30,000,000 for the Queens Bridge and Red Hook projects in New York City; $4,261,000 for Louisville, Ky.; $1,369,000 for Augusta, Ga.; and $1,027,000 for Jacksonville, Fla.

Cement Statistics

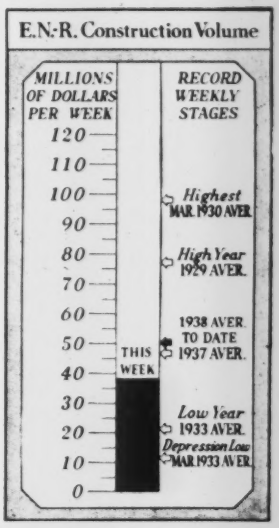
Portland cement production for March, 1938, totals 5,879,000 barrels; shipments, 7,259,000 barrels; and stocks at the end of the month 22,981,000 barrels, according to the U. S. Bureau of Mines. Production is 50 per cent above February, 1938, but 30.4 per cent below March, 1937. Shipments are 58.6 per cent above February, but 7.9 per cent under a year ago.

Production for the first quarter of 1938 totals 14,329,000 barrels, and shipments total 16,224,000 barrels, 31 and 8.5 per cent lower, respectively, than the first quarter of 1937.

Ratio of production to capacity of the mills is 26.9 per cent for March, 1938, as against 19.8 per cent in February, and 38.6 per cent in March, 1937.

Business Briefs

COMMON BRICK SHIPMENTS total 97,351,000 brick in February, 1938, an increase of 10.3 per cent over January shipments as reported by the Bureau of the Census. February face brick shipments, 30,125,000, are 14.5 per cent above January; while vitrified paving brick shipments, 2,087,000, are 17.7 per cent lower. Hollow building tile shipments total 50,090 tons, a 4.1 per cent gain over January shipments.



THIS WEEK'S FIGURES

(Thousands of Dollars)

CONTRACTS

	Week Ending Apr. 29 1937	Apr. 21 1938	Apr. 28 1938
Federal	$1,965	$1,490	$1,043
State & Municipal	16,488	24,170	22,279
Total public	$18,453	$25,660	$23,322
Total private ...	21,811	13,770	14,875
TOTALS	$40,264	$39,430	$38,197

Cumulative
1938 (17 weeks).....$855,336
1937 (17 weeks).....$736,017

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1937 17 Wk.	1938 17 Wk.
NON-FEDERAL	$487,470	$431,837
State & Mun. bonds.	184,590	211,645
Corporate securities..	225,613	101,250
PWA loans, grants....	48,128	2,029
RFC loans	29,139	63,420
U.S.H.A. loans	.....	53,493
FEDERAL	.....	86,532
TOTAL CAPITAL	$487,470	$518,369

ENR INDEX NUMBERS

Index Base	1913	1926
Construction Cost (Apr.)....	237.95	114.38
Building Cost (Apr.).....	198.21	107.15
Construction Volume (Mar.)..	188.	82.

ABERTHAW INDEX OF INDUSTRIAL building costs stands at 194.3 for the quarter ending March 31, 1938. This is 1.4 points, or 0.7 per cent below the 195.7 reported for the final 1937 quarter. Lower steel sash, and roofing and flashing prices are responsible for the decrease; wage rate averages remain unchanged.

AMERICAN APPRAISAL COMPANY'S building cost index for March, 1938, remains at 183 for the third successive month, but 3 per cent above the 178 reported in March, 1937. Belated wage increases in some cities are offset by decreases in others.

Power Commission Checked by Court

District court denies assumed control over the tributaries of navigable streams

Assumed powers of the Federal Power Commission to control the construction and operation of power plants on tributaries to navigable streams were swept away by Judge John Paul of the U. S. District Court for the Western District of Virginia in a decision handed down on Apr. 21 in an injunction suit brought by the U. S. Government to keep the Appalachian Power Co. from building a hydro-electric power plant on the New River near Radford, Va. The plant is now under construction under a permit from the state.

The suit was brought at the instigation of the Federal Power Commission which claimed that the New River at that point is a navigable river, and so subject to control of Congress, and further that operation of the power plant would adversely affect navigation of the Kanawha River into which the New River flows. Under either condition, the commission held, the power company had to obtain a license.

The court found that the New River was not a navigable water of the United States and that operation of the plant would in no way affect the navigable capacity of the Kanawha. It found further that there is nothing in the Federal Power Act to indicate that Congress intended to give the commission power to require a license for a dam not built on navigable waters of the United States. The court pointed out that local intrastate navigation did not put such a stream into the class over which Congress has control.

The New River is a rapid stream with an average slope of over 7 ft. per mile. During the early days of development of the region it was used by small boats in two of its flatter sections, but the traffic was purely intrastate, according to the findings of the court, and no traffic now exists. The Kanawha, formed by the confluence of the New and the Gauley has a slope of 1.25 and has been developed for navigation up to Kanawha Falls, just below the mouth of the New River.

The court found that normal operation of the plant would in no way affect the Kanawha, and drew heavily upon findings of the Corps of Engineers as to non-navigability of the stream. Judge Paul made note of the fact that the government witnesses in attempting to make a case went to absurd extremes in efforts to show that operation of the plant would affect navigation on the Kanawha. On this he said, "the court cannot base injunctions on speculative grounds such as this."

Judge Paul also noted that the federal government plans to build the Bluestone flood-control reservoir below Radford Dam. Its reservoir will be so large, said Judge Paul, that no possible extremes of operation at Radford could affect the flow of the lower river.

In reviewing the history of the case Judge Paul noted that the power company had agreed to accept a minor part license giving the government power to regulate its control of the flow of the river in the interests of navigation and called attention to the fact that the commission had denied that application, despite the fact that both the Chief of Engineers and the Attorney General had found that the stream was not navigable. The Attorney General said that the government had no power to prevent construction of the plant unless it will impair the navigability of the Kanawha, hence issue of a minor-part license would adequately protect the interests of the U. S. He added "this interpretation appears necessary to avoid serious question as to the constitutionality of the Act." In the light of these opinions and the fact that at an earlier date the commission as then constituted found the river non-navigable, Judge Paul said he found it difficult to understand the position now taken.

Efforts of the Federal Power Commission to take control over power development on the New River have extended over several years. An earlier suit was thrown out by the Supreme Court on a technical point.

Cement Bids Rejected

The Procurement Division of the federal government on April 22 rejected all of the bids received April 15 for cement to meet the needs of the government for the next four months. The bids were rejected "for the government's interest" without further explanation, but it is understood that new bids will be called in a second attempt to centralize government purchases of cement. It is not known on what basis further bids may be asked.

The government feels progress was made in inducing competition but that bids received did not meet completely its need in all sections of the country.

Milwaukee Halts Cement Buying

City will await effect of new federal purchasing policy on cost of cement

Purchase of the next four months supply of cement for the city of Milwaukee has been held up to await the effect of the new federal plan for central purchasing of cement. The city purchasing board recently opened bids from about twenty dealers and found that all but one offered uniform bids of $2.50 a barrel for cement in paper bags and $2.73 in cloth bags. One dealer, the Norman J. Pitkorn Co., submitted a bid of $2.44 and $2.73.

City purchasing agent Nicholson said that because there was one low bid, no investigation of collusive bidding would be made. Had all bids been the same, he said, the Federal Trade Commission would have been asked to make an inquiry.

The Pitkorn company claims that its low bidding in the past has been opposed by manufacturers and that as a result it has been able to buy from only one concern. Philip Bliffert, counsel for 24 dealers in Milwaukee county, denied that collusive bidding is prevalent among dealers there and said that bids submitted to the federal government under the new plan were below prices at which dealers can buy from manufacturers.

If the national market falls because of the new federal policy, Nicholson said, the Milwaukee purchasing board may reject all bids and re-advertise.

• • •

Students Receive Awards In Design Competition

First prize in the student design competition held by the American Institute of Steel Construction has been awarded to Erling F. Iverson of Princeton University. Second prize went to Robert H. Hose of Massachusetts Institute of Technology, and third prize to James H. Walsh of Iowa State College. Robert L. Abbott and Harold F. Bianco, also of Iowa State, received honorable mention, as did Brandt Gessel of the University of Idaho, Charles E. Lex 3rd of Ohio State University, and Vincent W. Seebach of New York University.

Selections were made by a jury consisting of Frank M. Masters, Harrisburg consulting engineer, E. H. Praeger, chief engineer, Madigan-Hyland, New York City; Aymar Embury II and Randolph Evans, New York City architects; and George Nelson, associate editor of the Architectural Forum.

More Contracts Made For Housing

Loan contracts of $36,657,000 approved for six low-cost housing projects

Presidential approval was granted on April 20 to a second group of allotments by the U. S. Housing Authority to municipal housing agencies. Loans totaling $36,657,000 were granted covering 90 per cent of the construction cost of six projects in four cities—New York, Louisville, Augusta, and Jacksonville. This is the second group of allotments, $16,836,000 having been loaned on March 17 to five cities. Fiscal details of the loan are indicated on the table below.

The major portion of the newly allotted money was for New York City, which will receive a loan of $30,000,000 covering two projects costing $33,333,000.

New York projects

The larger of the New York projects is located in the Red Hook section of South Brooklyn and will provide 2,643 dwelling units. It will contain 25 six-story apartment buildings of the "cross unit" type, occupying 19 per cent of the site area. The buildings are designed with exterior brick walls, interior steel columns, interior partitions of 2-in. solid plaster on metal lath, and either bar joist or solid slab floors. The six-story construction, which requires elevators under New York City law, was adopted to keep a maximum amount of land free for recreational purposes. One of the structures will be a large general community building for the entire project.

The Queensbridge project in Long Island City in the Borough of Queens will house 2,551 families. It will have 29 six-story fireproof apartment buildings of a Y-shape. The buildings in this project will occupy 23 per cent of the site. The structural design of the buildings will be the same as for the Red Hook project.

In announcing the loans, Administrator Straus stated that two recent rulings have facilitated his program. The limitation that only 10 per cent of total funds may be loaned in any one state has been interpreted by the Attorney-General to apply to the total authorization of $500,000,000 for the three-year program, but not to the amount expended in any one year. This means that in states like New York and Ohio, where the demand for loans is great, construction can go forward immediately on projects requiring loans up to $50,000,000 rather than $10,000,000.

The other favorable ruling comes from the Comptroller of the Currency. He held that national banks may finance the bonds of local housing authorities. This will greatly facilitate the raising of the 10 per cent of construction cost that must be furnished by local contributions.

President Roosevelt's recent pump-priming message proposes increasing the amount authorized for expenditure in slum-clearance housing projects, and appropriate legislation is in preparation. While it is doubtful whether an increase in the total authorization is immediately necessary, such a move would be distinctly beneficial in that it would permit an expanded program in certain states already cramped by the 10 per cent limitation in the Wagner Act.

• • •

Truck Toll Cut On Bay Bridge

A 31 per cent cut in the toll charged for trucks crossing San Francisco-Oakland Bay Bridge was ordered April 21 by the California Toll Bridge Authority. The charge for an empty truck or trailer, previously 75 cents, was reduced to 60 cents, and the 3 cent per 100 lb. charge for freight on trucks was reduced to 2 cents per 100 lb. Directors of the authority expect to receive an increased revenue of $45,000 on the basis of the new toll.

On the same day, an agreement with the Reconstruction Finance Corp. for refinancing bridge bonds held by RFC was approved by the authority. The new agreement calls for an issue of $77,000,000 in bonds at an average interest rate of 4.13 per cent. The issue includes $4,000,000 above the amount needed to complete the installation of electric railway facilities on the bridge which will be available for the purchase of the competitive Southern Pacific-Golden Gate ferries, when such purchase is authorized by the legislature. The agreement, however, does not require purchase of the ferries.

FIGURES ON SIX HOUSING PROJECTS

City	Dwelling Units	Aver. Cost per Unit	Total Cost †	USHA Loan	Monthly Rental per room*
New York, N. Y. (2 projects)	5,194	$4,626	$33,333,000	$30,000,000	$5.15
Louisville, Ky.	814	3,656	4,734,000	4,261,000	4.00
Augusta, Ga. (2 projects)	335	3,709	1,521,000	1,369,000	3.50
Jacksonville, Fla.	224	3,833	1,140,625	1,027,000	3.80

* Includes water; additional charge for other utilities.
† Includes land and demolition.

Strike on Federal Jobs Ends in St. Louis

Building Trades Council calls off strike when disputed bridge project is shut down

The general strike on federally financed projects in St. Louis and in St. Louis and St. Charles counties called by the St. Louis Building Trades Council April 4 (*ENR* April 14, 1938, p. 526) was terminated April 18 without having forced employment of A.F.L. workers on a bridge repair job at St. Charles, Mo., which was partly financed by federal aid funds.

The Massman Construction Co. of Kansas City, contractors on the bridge job, shut down the work there, and secretary Church of the Building Trades Council said, "We decided there was no point in continuing the demonstration, since the bridge work had been stopped."

Independent union

The strike was called after the Massman company attempted to carry on the bridge job under an agreement with the Independent Workers Organization, a body not affiliated with either the A.F.L. or the C.I.O. The independent body was formed during the course of labor disputes which were successful in enforcing a 90 cent an hour wage scale for common labor on levee construction projects in the St. Louis area. The contract with the Massman company calls for wage scales ranging from 67½ cents an hour for common labor to $1.50 for skilled workers.

Union leaders announced that another general strike would be called if an attempt were made to continue the bridge job with workers affiliated to the I.W.O.

I.W.O. halts PWA jobs

On the same day on which A.F.L. workers went back to work on PWA projects, about 200 members of the Independent Workers Organization visited three PWA school construction projects and chased A.F.L. workmen off the jobs.

WPA wage scale

Meanwhile officials of the I.W.O. obtained the support of the St. Charles county court in a demand that the wage scale on $125,000 worth of WPA road improvement projects be raised from 36 cents to 50 cents an hour for common labor. The court agreed to stop the work and to accompany an I.W.O. committee to visit WPA Director Reigel and urge him to grant the wage increase.

Civil Engineers Expand Activities

New hydraulic division set up and funds asked from Engineering Foundation for research

Activities of the American Society of Civil Engineers are to be expanded through the organization of a division of hydraulics and through the inauguration of research in both the field of hydraulics and of soil mechanics as a result of action taken by the board of direction of the society at its spring meeting held in Jacksonville, Fla. April 20-23. The society will ask Engineering Foundation for $1,500 for research in hydraulics and for $6,100 for research to be carried on under the direction of the soil mechanics division. The society's standing committee on hydraulics has been abolished and its functions are to be transferred to the new division.

Revamping the procedure for electing new members to the society is provided for in a by-law approved by the board. The board also authorized the secretary to cooperate with the other founder societies in developing publicity for the engineering profession.

Establishment of a Wyoming Section and of a Mohawk-Hudson Section was approved by the board. New student chapters accepted are as follows: The Citadel, S. C.; Speed Scientific School, University of Louisville; University of Detroit; University of Santa Clara.

Economic activities

The board urged local sections to appoint standing committees on registration of engineers to uphold and watch over the operation of state registration laws. The local section conference brought to the board a request that the board make improvement of the economic status of the engineer the major aim of the society. Similar action was taken by the Colorado Junior Branch which commended the board for its activity in collecting data on fees and salaries of engineers. The board also urged the local section to establish junior branches and to encourage younger members.

Action on Morgan

Declaring its high respect for the personal integrity of Arthur E. Morgan, the board of direction adopted a resolution urging the Congressional committee now set up to investigate the Tennessee Valley Authority to make a thorough investigation of such matters as Dr. Morgan may wish to place before it and recommending that the committee give full publicity to its proceedings.

Over 600 members and guests were registered for the meeting which was held under the auspices of the Florida Section and the Florida Engineering Society. On Thursday a joint session was held with the American Shore and Beach Preservation Association.

The technical meetings were opened by a general session devoted to the part played by engineers in the pulp and phosphate industry of Florida. Meetings were held by the following technical divisions: surveying and mapping, sanitary engineering, waterways and highways. A report of these meetings will be published in our issue of May 5.

Willard T. Chevalier, vice-president, McGraw-Hill Publishing Co., spoke at the closing dinner meeting on Thursday, taking as his subject the present problems of the civil engineering profession. Colonel Chevalier stressed the obligation of the engineer to take his place alongside the bankers, politicians and public administrators in creating a favorable and equitable environment in which members of the profession can utilize their talents. With these larger problems solved, the problem of the economic status of the engineer will take care of itself, the Colonel said.

The inspection trips included a visit to St. Augustine, to Ocala, to see the suspended work on the Florida ship canal, to Silver Springs, the Marine Studios, and to pulp, turpentine and tung-oil plants.

Connecticut Road Funds On New Basis

Individual projects are to be approved by governor and finance department

Starting with the beginning of the fiscal year on July 1, highway funds in Connecticut will be handled on a project basis. Each project will be estimated by the highway department and submitted to the governor and the department of finance and control for allotment of funds. This system is already in use by the state department of public works.

Governor may veto

The plan, formulated by Budget Director Whitaker, will replace the present system, which allowed the highway department to spend as it saw fit all motor vehicle revenues not definitely committed by other legislation. Under the new arrangement, the governor will have the power to veto individual highway construction projects if he wishes to.

Allocation of highway department funds for the new fiscal year will be submitted to Governor Cross by July 1. As projects develop, the maximum amounts available for each project will be alloted and used by the highway department.

Photo by C. E. Bo[illegible]

BRIDGE BLOWS AWAY

DIRECTLY in the path of the tornado which passed through Adams county, Ill., on March 30, this 97-ft. steel bridge was completely destroyed. The structure had been inspected shortly before the disaster and is believed to have been in good condition.

The wind lifted the span from the foundation and deposited it against a rock ledge upstream from the bridge site. During the night heavy rains caused the creek to rise and the bridge was carried down the stream about 75 ft. below the bridge site.

WASHINGTON HIGHLIGHTS

Special reports by Paul Wooton

THE U. S. SUPREME COURT on April 25 indicated that it would hear oral arguments before deciding the request of the Attorney-General that the United States be permitted to intervene in litigation between Nebraska and the states of Wyoming and Colorado over the division of water in the North Platte River. In this case the federal government has advanced the argument that unappropriated waters of western streams belong to the United States, since the territory was purchased by the federal government from Spain, France, Mexico, and Texas, and the water rights have never been surrendered. This contention is the basis for the government's plea for leave to intervene.

PRIME MINISTER Patullo of British Columbia visited Washington April 21 to discuss with American officials the possibility of building a 16-ft. gravel highway through his province to connect the northwestern United States with Alaska at an estimated cost of $17,000,000. The discussion centered principally about the problem of financing the undertaking, but no conclusion was reached. British Columbia is represented to be eager to build the road but unable to finance it because of other obligations.

After leaving Washington the Prime Minister visited Ottawa, where the discussion was continued with Canadian officials.

A STUDY of the practicability and an estimate of the cost of building a combined railway tunnel and vehicular bridge across the Potomac River to replace separate structures now located at the south end of 14th Street, Washington, is called for in a bill introduced by Rep. Smith of Virginia.

• • •

House Changes Stand On Gilbertsville

Reversing a previous stand, the House of Representatives on April 25 accepted a conference recommendation for an appropriation of $2,613,000 to start construction of the Gilbertsville dam planned by the TVA in Kentucky.

When it first considered the independent offices bill, the House struck out this appropriation. The appropriation was reinserted by the Senate and was kept in the conference report on the bill.

Delaware Aqueduct Enjoined by Court

Award of $32,000,000 of contracts for construction of New York City's Delaware Aqueduct was temporarily enjoined April 26 by the Brooklyn Supreme Court, on the ground that wage schedules were exorbitant.

The injunction suit was brought as a taxpayer's action and the claimant asserted that the wage schedule under which these bids were asked was 20 per cent higher than the prevailing rate scales.

Award of the contracts was held up once before when the city controller obtained a downward revision of the wage rates which were certified as then prevailing.

• • •

Fellowships Offered For Road Study

Fifteen $1,400 fellowships for the study of highway traffic problems are being offered by the Bureau of Street Traffic Research of Yale University. The fellowships cover a year's study at Yale during the academic year 1938-1939.

The fellows will take four graduate courses being offered by the Bureau. These are a course in principles of traffic control; a seminar in problems of traffic control; and lecture courses in planning and design of traffic facilities and economics and administration of traffic control. Research facilities will be provided for any fellow to permit him to concentrate on a specialty.

The fellowships are open to engineering graduates between the ages of 23 and 30. Applications must be submitted to Maxwell Halsey, associate director of the Bureau for Street Traffic Research at Yale University. Applications must be sent to him before June 1, 1938.

• • •

Colorado-New Mexico Compact Upheld

(*Continued from page 601*)

water of an interstate stream be made by compact between the upper and lower states with the consent of Congress or by a decree of this court, the apportionment is binding upon the citizens of each state and all water claimants, even where the state has granted the water rights before it entered into the compact." The court pointed out that this rule is analogous to the fact that "private rights of grantees of a state are determined by the adjustment by compact of a disputed boundary."

LABOR NOTES

TWO UNIONS of plumbers were united April 18 when the membership of the Alteration Plumbers, Steamfitters and Helpers' Union, an independent group numbering about 3,500, voted to unite with the United Association of Journeymen Plumbers and Steamfitters affiliated with A.F.L.

A SUCCESS was registered for the arbitration plan of the Essex County, N. J., building trades council when carpenters went back to work on an apartment house in Newark. The carpenters went on strike March 31 charging that sub-scale wages were being paid (*ENR*, April 14, 1938, p. 526). Because the carpenters had not sought to arbitrate the dispute before striking, the building trades council refused to sanction the strike and ordered workmen to continue working with non-union carpenters. The carpenters have now submitted the dispute to arbitration and union men replaced the non-union workers April 25.

ALSO BACK AT WORK are bricklayers of Warren, Ohio. On April 21 they agreed to accept a continuation of their $1.50 scale, ending a 19-day strike in which they sought a scale of $1.62½. Carpenters in Warren similarly agreed on April 1 to continue the existing scale of $1.20.

• • •

New Bankruptcy Act Upheld by Court

The U. S. Supreme Court on April 25 upheld the constitutionality of the revised municipal bankruptcy act of 1937, passed to replace the earlier act that was declared unconstitutional by the same court in 1936. The vote this time was 6-2, with Justices McReynolds and Butler dissenting and Justice Cardozo not participating.

The Court ruled that its objections to the earlier act had been considered and avoided by Congress in framing the substitute measure, and that the law no longer interferes unduly with the control of the states over municipal finances.

The act permits the voluntary readjustment of debts by municipalities and other political sub-divisions of a state when two-thirds of the debtors and the state government agree upon a reorganization plan. The test case was brought to the Court by creditors of the Lindsay-Strathmore Irrigation District of Tulare County, Calif.

Further news on page 631

COMMENT AND DISCUSSION

Readers' opinions on matters that concern the engineer

Building Inspection

Sir: Your editorial on the Building Inspector in the issue of April 14 was fine. My experience in this work positively assures me that an engineering education is necessary for any inspector to carry out his duties. The problems on public building construction which arise in the field and must be correctly answered are numerous. Prof. Bart J. Shine's excellent report on cracks in walls in the same issue is a splendid illustation of one such problem. Many thanks for your weekly collection of clear, helpful facts.

HOWARD MEIXNER
Montoursville, Pa.
April 19, 1938

Waterworks Operation

Sir: In the article by your associate editor, W. W. DeBerard on the municipal waterworks at Des Moines, Ia. (*ENR*, Feb. 17, p. 265), it is stated the quantity of water billed from meters is 68.8 per cent of that pumped exclusive of certain municipal uses. I should be grateful if you would inform me of the percentages of the two dozen municipal items, which you mention, to the total quantity of water pumped.

This information would provide valuable data for estimating purposes, particularly so for a city such as Jerusalem which is dependent on water pumped against a high head from a far distance. U. HEDLEY
Acting Director of Public Works
Government of Palestine
Public Works Department
Jerusalem, March 15, 1938

Sir: The following information is presented in answer to Mr. Hedley's inquiry. In order to arrive at the total water metered in Des Moines, there should be added to the 68.8 per cent 2.2 per cent of the total amount pumped, which was used by the city at 140 locations; this includes fire stations, water troughs, rest rooms, market house, libraries, garbage plant, swimming pools, muncipal airport, playgrounds, parks, garages, etc., and it was metered but not billed.

Also slightly over 1 per cent of the total water pumped was used by the water department through metered services. This would make a total of 72 per cent of the water pumped actually accounted for through meters.

The breakdown of the remaining 18 per cent can only be estimated, and for this purpose we use the following figures submitted by the Pitometer Co. regarding our supply:

Estimated unmetered public use, which includes flushing and cleaning of sewers, flushing snow from streets, cleaning streets, skating rinks, city construction work, blowing off dead ends, etc., 3.2 per cent. Under registration of domestic and industrial meters and unauthorized use, 4.2 per cent. This would leave about 10.6 per cent as leakage and unaccounted for water.

We are happy to report that the water billed and metered for Des Moines during 1937 was increased to 72.88 per cent of the total pumped.

DALE L. MAFFITT
General Manager
Des Moines Water Works
Des Moines, Ia., April 6, 1938

Flood Benefits Questioned

Sir: The article on Navigation and Flood Control at Gilbertsville by Carl A. Bock, in your issue of April 7, 1938, p. 497, is a challenging description of a proposed great power and flood control reservoir. For this project it is proposed to spend some $112,000,000, justified, one gathers from reading the article, largely by some $90,000,000 of flood control benefits in the upper portion of the alluvial valley of the Mississippi River. If this project will accomplish what is claimed for it, the indicated expenditure might or might not be justified depending (1) on whether this is the most economic method of supplying the protection, and (2) the reliability of the estimate of benefits given.

Before discussing the question of benefits, it might be well to examine the project to determine whether it is possible that it might fail in its purpose. The volume of controlled flood storage is given as 4,600,000 acre-ft., the equivalent of 2.3 in. of runoff from the drainage area excluding the areas of the Norris, Hiwassee and Fontana reservoirs. The other main river reservoirs are not considered as their capacity would hardly more than offset the valley storage lost in a really great flood. The writer knows of many large flood control reservoirs in eastern United States but he knows of none with a controlled capacity of less than 4 in. of runoff from the drainage area. It has been his experience that the valley storage for a great flood in a flood-control reservoir of this type is frequently equal to 2 in. of runoff from the drainage area. He therefore wonders whether the proposed reservoir would have any positive effect in a great flood at Cairo with 800,000 sec.-ft. flowing in the Tennessee and forming the crest at Cairo. The statement is noted in Mr. Bock's article that the reservoir would not eliminate the natural storage in the Tennessee in an Ohio flood as flow in the Tennessee would always be great enough to fill this natural storage. If the flow were only great enough to fill this storage the reservoir would only have the small effect of holding back the natural storage. The effect of this, at best, would hardly be more than a foot at Cairo. The writer suggests that studies may show that the effect of this reservoir in a great flood may be much less than the 2.3 ft. minimum stated.

How will the reservoir be operated? Will it be used to lower the crest for an 1896, 1912, 1913, 1927, 1929 or 1937 flood at Cairo? How will the operators know when to start storing so as to utilize to best advantage that precious 2.3 in. of storage? Supposing the crest is predicted and storage is carried out and then heavy rains fall to start a second and higher crest as has happened in the past; will the reservoir then be effective? Can we say positively that a great flood will not come in April or May?

We have only 100 years of record to go by, and in that period the greatest flood out of the upper Mississippi occurred in July at Cairo. It hardly seems possible to positively provide protection when it is most needed and reduce the crest stages of lesser floods that do not threaten the levee system.

Apparently no claim is made for benefits in the lower portion of the valley. Logically this reservoir could not be expected to have appreciable benefits much below the mouth of the St. Francis. Undoubtedly they would disappear at the mouth of the Arkansas. Equivalent protection to lands now protected could be obtained by raising the levees an average of two feet from Cairo to the Arkansas. The cost of this levee raising, maintaining present sections, and providing equivalent safety would be about $15,000,000 including the cities. Still further safety could be provided by a cutoff at Slough Landing Neck and other channel improvement. At one time the opinion was quite generally held that it would not be safe to raise the levee system this much. Now, with recent improvements in design methods due to the development of soil mechanics, the engineers on the Mississippi are quite capable of handling the problem safely.

Other items of benefit, in addition to positive protection, are reduction in depth and extent of flooding of unprotected areas, benefits to floodways from fewer overflows, lessened seepage, reduction in levee maintenance and savings in cost of raising railways and highways. The writer, from his years of experience on the Mississippi River, can hardly see where these benefits would make up a fraction of the difference between 15 million and 90 million dollars. It is probable that the 15 million should be spent in levee raising regardless of the reservoir construction, since the protection offered by Gilbertsville is not positive. As for floodways, the only one that might be affected is the New Madrid Floodway, in which the federal government has already purchased flowage. Since a reservoir of limited capacity, such as the Gilbertsville reservoir, can only be used to change the shape of the flood crest and possibly prolong it, the net effect on seepage may be more unfavorable than otherwise in some cases. Since a governing factor in backwater elevation is length of crest rather than a peak stage of short duration, the operation of Gilbertsville should not appreciably reduce backwater areas in the St. Francis Basins, the only areas that it might be considered as benefitting.

It is interesting to note that the TVA has employed such an eminent board of consultants in the design of the project. The makeup of the board is a guarantee of the soundness of the designs. Had the same board or a similar one approved the economic analysis one might hesitate before questioning the results. Likewise, the estimate of benefits would have been more convincing had it been made by the engineers of the Mississippi River Commission who are intimately in touch with the lower river.

Attention is invited to the table on p. 499, "Comparative Costs of Flood Reduction." The author fails to point out in presenting this table that the Ohio and Missouri River reservoirs are primarily for local protection on those streams and their tributaries. As I understand it, from reading the document referred to in the article, these reservoirs are justified to a large extent by the benefits on the tributaries rather than on the lower Mississippi. It is probable that a revision of the figures in his table, to show the cost chargeable to the Mississippi for the construction of these reservoirs, would show their cost per second-foot of flow reduction for the Mississippi at Cairo to be much less than that for Gilbertsville. It should be noted also that these reservoirs provide 22,741,000 acre-ft. of controlled storage as against 4,600,000 claimed for Gilbertsville. This is 67 acre-ft. per 1,000 sec.-ft. reduction as against 23 acre-ft. for Gilbertsville.

THEODORE T. KNAPPEN
Consulting Engineer
New York, April 20, 1938

High Speeds Not New

Sir: In these days when so much is being said about high-speed trains as a new element of railroad service we are inclined to overlook the fact that the railroads went through an era of high-speed train operation shortly after the Civil War.

As a boy in Roxbury, Vt., I heard a very interesting story to the effect that in the early days there was great rivalry between the Central Vermont and the Rutland & Burlington roads for the contract for carrying the English mail between Montreal and Boston. To determine the best line a race was run by light engines over the two lines. The Central won.

I remember hearing Luther Hassam telling of being at the station in Northfield when the Central's racing engine went through. He said the whole village was at the station to see it. Gov. Paine, whose home was at Northfield and who was president of the Central was there. Hassam said the Governor took out his watch and said "If they don't whistle in here in five seconds, they are off the iron." Before he got his watch back in his pocket the engine came around the bend.

It was said that the racing engine on the Rutland road found a rail out on the inside of a curve, but being too close to it when first seen to stop, the engineman ran over it without accident. This seems like improbability.

Presumably if the race was fact, the Central road used the engine "Gov. Paine" built for it by Baldwin to meet a specified speed of sixty miles per hour. It had driving wheels six and a half feet in diameter.

WM. P. SNOW
Auburndale, Mass., April 2, 1938

Ship Impact

Sir: After having expectantly, but in vain, perused *ENR* for correction of several errors in Professor Andersen's analysis of impact on wharves (*ENR*, Nov. 18, 1937, p. 822), I am prompted to submit the following:

In equation (1) l_3^2 in the third term of the left hand member should be l_3^3.

In equation (4) l_1^3 should be l_1^6 in the second and third terms of the left hand member;

Equation (5) should read

$$\frac{P_1^2 l_1^2}{24 E K_1^4 \Sigma K^3} = \frac{W v^2}{2gN}$$

Another form of the work-energy equation for the deflection and the moments, entailing perhaps less labor in numerical computation, is:

$$\Delta = \frac{L_1^2}{6EI} \sqrt{\frac{3\,WEI}{L_1 g N\left[1 + \left(\frac{L_1}{L_2}\right)^3 + \left(\frac{L_1}{L_3}\right)^3 + \ldots\right]}}$$

$$M_n = v\left(\frac{L_1}{L_n}\right)^2 \sqrt{\frac{3\,WEI}{L_1 g N\left[1 + \left(\frac{L_1}{2}\right)^3 + \left(\frac{L_1}{L_3}\right)^3 + \ldots\right]}}$$

B. A. JOHNSON
Harvey A. Hanson Const. Co.
Chicago, Illinois.

ENGINEERING NEWS-RECORD

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Editorial Offices at 330 West 42nd Street, New York

APRIL 28, 1938

FIRST CHECK to the government's persistent efforts to take authority over streams from the states was administered by a district court through decision on the long-pending Appalachian Power Co. case involving construction of a dam on the non-navigable New river in West Virginia. The federal government, the court in effect says, has power over navigation through the Interstate Commerce clause of the constitution, but is devoid of other authority over streams. It is encouraging to have so clear and fundamental a statement of the law, and to learn that the law does not recognize the federal government's right to trespass on state control over streams. Consistent application of this doctrine holds out hope for orderly progress in flood control, water conservation, and power development, hope that a field of activity thrown into hopeless confusion can be readjusted to normal and constructive management of our resources.

Mills of the Gods

SUBTERRANEAN NOISES heard and recorded in California wells close to major fault lines, most probably arising from small movements within the earth's crust, may prove to be indicators of strains and stresses similar to those whose sudden readjustment is associated with destructive earthquakes. The discovery of the noises, announced in the present issue, is therefore of great importance. While interpretations and conclusions must for the present remain speculative, it is hardly open to doubt that the noises arise from movements of some kind; something is going on within the earth's crust, whether continuous and unimportant or a precursor of more abrupt and violent happenings. Earlier observations have indicated that stress accumulates in the crust of the earth and that occasionally this stress produces large shearing or sliding movements, such as the longitudinal slip on the San Andreas rift that accompanied the destructive 1906 earthquake at San Francisco. It may be that the present noise observations contain advance microphone warning of some coming readjustment—warning that might be of incalculable value, for though we cannot stop the mills of the gods we may in some degree guard against the harm they do. Whatever it is that is going on within the earth, it is worth watching; the observational work should continue.

No Loans Needed

IT WAS ANNOUNCED last week that the federal government is considering means for making loans to electric utilities to facilitate their purchase of equipment and so help to stimulate business. That field is one in which no loans are needed; all that is needed is restored confidence. Let the President say that the federal government will make no further excursions into the business of producing and selling power at arbitrary prices and that it will not subsidize competing plants by cities or force the dismemberment of existing systems, and the money needed for expansion of our power supply system will be forthcoming. A vast reservoir of new construction calling for a wide variety of manufactured products and materials awaits not the promise of loans but a promise that the uncertainty now hanging over the electric utility business will be eliminated.

Cement Prices

AN INTERESTING FACT appears from the country-wide bids on cement opened by the Procurement division of the Treasury two weeks ago. When referred to average delivery points the bids are not materially different from current quotations. It seems, therefore, that the cost of supplying cement under a radically new system does not differ greatly from the cost reflected by market prices. The government probably expected to develop sharp underbidding, but the one-sided terms meant large risks to the seller and therefore high prices; apparently the two tendencies balanced out. The bidding showed that manufacturers entered actively into the new bidding plan and calculated prices and costs as closely as seemed safe and prudent in the light of individual business judgment. The results thus refute the charge sometimes made that cement prices are artificial or collusive. Whether the new system of cement buying would have meant a saving—the government has rejected the bids—appears questionable; indeed, complications in ordering and delivery might have increased the final cost.

Official Confusion

WE BADLY NEED greater official consciousness of the importance of the work of traffic engineers; confusion of official thinking on this subject frequently stands in the way of progress. Thus, with two authoritative safety reports before it, both of them advising the appointment of traffic engin-

cers. Detroit has been hesitating over the usefulness of such experts. It is not difficult to understand this attitude, for the man in the street is apt to think that traffic engineering means nothing more than stop-and-go lights and a corner cop. He does not realize that safe and efficient street use involves study of layout, traffic routing, intersection improvement, travel speeds, parking restrictions, and the like. Even city executives are foggy in their thinking on the subject. Street- traffic surveys and programs such as completed for Detroit need the propagandist particularly. Some of the efforts now being made to teach school children how to cross streets might accomplish more if directed to educating city officials and the public to the value of traffic engineering.

The Steward Reports

OUTSTANDING among the municipal reports issued this year is an attractive and informative booklet titled "San Diego Affairs, 1936-37." Effectively illustrated and packed with interesting facts interestingly described, it invites the reader to *study* its contents. And evidently this is what city manager R. W. Flack sought to accomplish when he set himself the task of making his yearly report to the citizens of San Diego.

Municipal reporting is one of the essential elements of public service administration. In most cases it is the only contact between those who pay taxes for community service and those who are charged with the stewardship of these services. Since the law requires an accounting of community finances, public officials are compelled to publish a yearly report of moneys received and expended. But the wise steward goes farther than this. He recognizes that by means of a report which does more than list statistics he can win citizen interest and support for worthwhile objectives.

Unfortunately, too few of our cities take advantage of this opportunity. The typical report is nothing more than the law requires—a formalized statement plus pages of financial data that only a C.P.A. can interpret. Yet there are hundreds of events in the administration of city services, events touching upon the daily life of every citizen, that are appropriate to an annual report: facts about the new refuse disposal system, the reasons for widening Main Street, the needs for better street signs, or the economy of central purchasing.

Not every city may feel justified in putting out a San Diego report. But even a mimeographed statement can be made to serve the requirements of good informative reporting; what can be done in this direction in small town is exemplified by the report of the Princeton (N.J.) department of public works. Regardless of size or money available, every town or city can profit by issuing an account of stewardship which can be read and understood by all its citizens.

Honor to a Leader

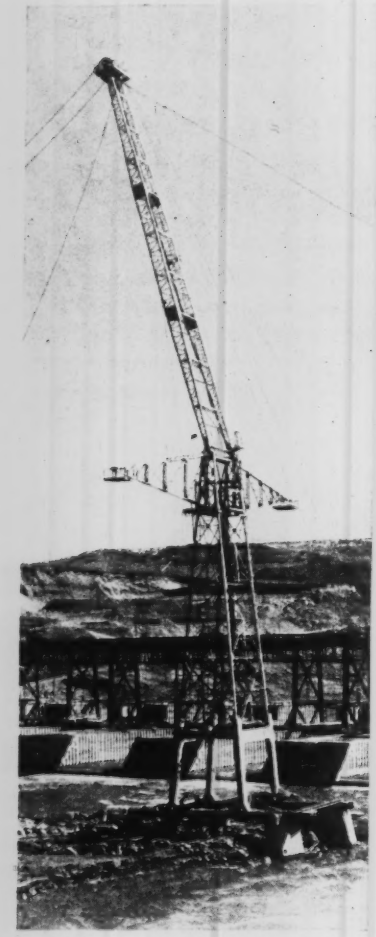
CIVIL ENGINEERING owes a large debt to Arthur N. Talbot, a debt that finds but imperfect expression in the rededication of the testing laboratory at Urbana in his name. For more than half a century he has been a torchbearer of civil engineering research; in addition to doing an incredible amount of investigative work himself, he has imbued a whole army of students and disciples with the spirit of fact-determination on which sound engineering accomplishment must rest.

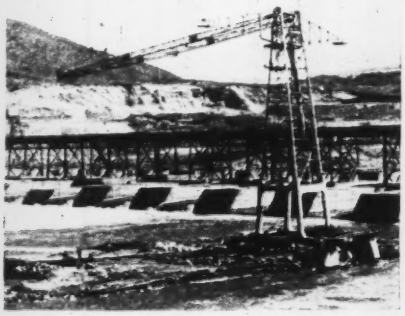
Prof. Talbot's own contributions touch nearly every field in which the civil engineer labors, from water supply and structures to railway track. His outstandingly great achievements are his basic tests of reinforced concrete construction and, above all, his monumental investigation into the mechanics of rail and roadbed action. The rail study in particular displays in its general conception his insight and creative power, in its execution his mastery of experimental method, infinite genius for detail, and uncanny ability in analyzing a mass of data and finding their necessary conclusion.

But greater and more lasting even than his own research accomplishment is what he achieved for civil engineering through others. His work and influence caused precise fact-determination to become an accepted element of civil engineering method. The light that shone from the Urbana experiment station nurtured the growth of similar research institutions elsewhere, and thereby further strengthened the recognition of factual study. His influence on his students and disciples sent out into the world scores, yes hundreds, of men inspired to carry forward investigative work on the Talbot model. These are gains that the entire profession gladly acknowledges and by which it will lastingly profit.

Truthseeking through keen and impartial objective study has no more inspiring exemplar than Talbot. It is this fact in particular that makes his work and his personality an inspiration. Neither impatient desire for quick results nor undue faith in routinized and mechanized organization of research as a substitute for personal effort found encouragement from him, but always he taught the value of searching, painstaking individual inquiry into facts. That inestimable guiding influence, which has made him a great leader of the profession, will live far into the future.

PICTURES IN THE NEWS





THERE IT GOES! An acetylene flame cuts the guy ropes and a 175-ft. section of the main tower of Grand Coulee's construction bridge begins its tumble into the Columbia River. The two-thirds-mile structure, not needed now that the low dam connects the two shores, was used to convey materials to the west side concrete mixing plant. Ten feet wide, it consisted of two central suspended spans of 1,437 ft. each and side spans of 420 ft. and 123 ft.

U. S. Bureau of Reclamation Photos

INDIGENOUS ARCHITECTURE in adobe block characterizes the administration building (below) in the construction town (population about 2,500) built by the Army Engineers at Conchas Dam on the New Mexican plains. Work on the dam, whose purpose is flood control on the South Canadian River and storage of irrigation water, is about 60 per cent complete.

Flood-Proof Bridge for Binghamton

by A. Burton Cohen

Consulting Engineer, New York, N. Y.

New Ferry St. bridge of three concrete arches is central unit in a traffic improvement project built after flood destroyed the old bridge

In the memorable and unprecedented flood of July, 1935, which inundated a very large portion of the City of Binghamton, N. Y., the old Ferry St. bridge over the Chenango River, built in 1897, was washed away. Since it furnished a vital connection between important sections of the city its loss from a traffic standpoint was serious, and steps were taken immediately to replace it. The new project, completed late last summer, includes not only a new river bridge on an improved alignment but extensive new approaches, one of which includes a four-track railroad grade separation structure.

Since the old bridge, consisting of four 84-ft. through steel girders, had proved inadequate to resist the flood and had in fact contributed to the general inundation by its damming effect, it was desired that the new bridge should be as near flood-proof as possible and should also provide a greatly increased clear waterway. As built, it consists of three 128½-ft. concrete barrel arch spans with open spandrel floor construction. The considerations which led to this design, the several novel structural details that were developed and in general the planning of the entire bridge and approach layout combined to make the project a notable one.

Flood considerations

The Chenango River, flowing south, has its confluence with the Susquehanna River, flowing west, about 4,000 ft. downstream from the site of the Ferry St. bridge. Only 78 miles long, the Chenango has a flash-like flood reaction. Its drainage area of 1,600 sq. mi. is completely covered by steep, sizable hills forming many narrow valleys and ravines. The run-off is accelerated by a multitude of short tributaries which branch out through this irregular topography like the veining of a closely-netted broad-top leaf. A mile of waterway, including brooks, creeks and small streams, for every square mile of drainage area, establishes the sensitiveness of the topography to a quick run-off. The maximum floods at Binghamton reach their peaks, 15 to 20 ft., in three days and recede as rapidly.

The drainage area, 56 miles long and 45 miles wide, across the numerous headwaters, narrows to a width of 14.5 miles about 13 miles north of Binghamton. Here the Tioughnioga River, the largest tributary, enters the Chenango. Through the city the waterway, which should be 400 ft. wide according to a recent Army Engineer study, has been restricted to a width varying from 270 to 400 ft. by river bank encroachments; at the old Ferry St. bridge the clear waterway was 332 ft. At flood peak there was a damming of the river at the bridge due to this restricted waterway and to the jumbled and unrelated position of the piers of two railroad bridges 430 ft. upstream and only 90 ft. apart. During the 1935 flood the water was 4 ft. higher along the upstream face of the Ferry St. bridge than it was at the Court St. bridge only 1500 ft. downstream; in a subsequent flood, with the Ferry St. bridge absent, the difference was only 0.6 ft. The bridge girders were submerged 1½ to 2 ft. when the bridge was washed away.

Geographic considerations

Binghamton is built up along the banks of the two rivers, the Chenango and the Susquehanna, with its central city jammed in the easterly quadrant of the wye formed by their confluence. Parallel with the Susquehanna, the main lines of the D.L.&W. and Erie Railroads on adjacent right-of-ways cross the Chenango upstream from the Ferry St. bridge and form another division line of the city. The most important resi-

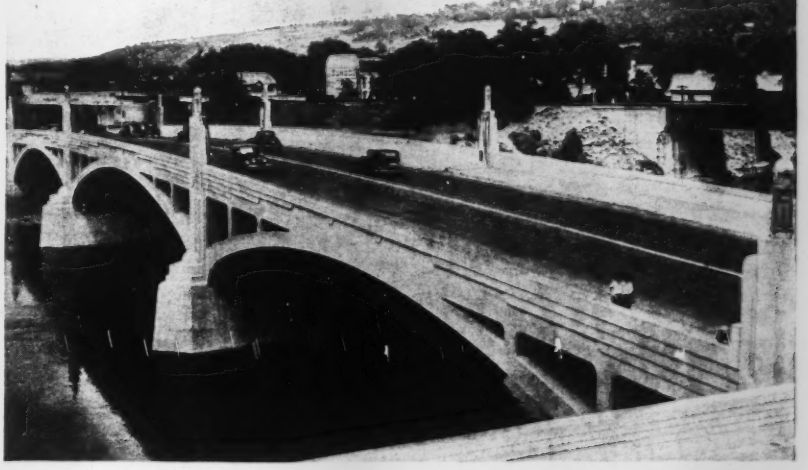


Fig. 1. New Ferry St. bridge over the Chenango River at Binghamton, N. Y., with new railroad undercrossing in background.

dential section lies west of the Chenango between the Susquehanna and the railroads. Another residential section lies along the south bank of the Susquehanna, while a fourth section, and the one which was most seriously affected by the destruction of the Ferry St. bridge and suffered the severest losses in the flood, lies west of the Chenango and north of the railroads. This section, locally called the "north side" and containing a secondary business section of growing importance, is both residential and industrial.

The principal function of the Ferry St. bridge is to connect this north side with the central city and to give quick outlets for traffic headed for Syracuse and points north through Front St. (U. S. Route 11) parallel with and adjacent to the west bank of the river. The old bridge had always been unsatisfactory because of inadequate approaches on either side consisting of a succession of short dead end, narrow streets and blind corners.

The adopted plan

The following recommendations were made to improve this traffic situation when restoring the old Ferry St. bridge:

(1) On the east approach, (Fig. 2) to extend Lewis St. through one block to the bridgehead thus eliminating two full traffic turns and giving straight alignment for traffic headed for the railroad stations along Lewis St., and for eastbound traffic headed for Scranton and points east to New York. Also, to widen Ferry St. and Wall St. along the east bank to four-lane capacities.

(2) To rotate the center line of the new bridge 15 deg. north so that it coincided with the direction of the preponderance of traffic toward the northwest sector of the city. This shift in alignment, rotated about its intersection with Wall St., placed the piers, which had to be in line with the flow of the stream, normal to the centerline of the bridge, thus simplifying construction.

(3) To project the new alignment of Ferry St. on the west side of the river through a new undercrossing of both railroads to a 45-deg. intersection with Clinton St. This would eliminate two full turns for traffic headed for the north side business section, one of the turns being an extremely dangerous one into Clinton St. at the old Front St. undercrossing, and the other being the T-intersection of Ferry St. with Front St.

(4) To develop the Front St. plaza for easy swings of traffic and pedestrian safety by using long radius curves and a large safety island in the center of Ferry St., and to carry this island through the undercrossing, dividing the four-lane highway into two double one-way lanes, each 22 ft. wide, the safety island also serving to support a center line of columns permitting the use of slab-deck instead of through girder construction for the railroad bridges.

These recommendations were accepted as the basis of the design, and in general the project, as built, incorporates them as outlined.

The flood-proof river bridge

Of the eight bridges that connect the various parts of Binghamton with the central city, all except one are of structural steel. The exception is a five-span reinforced concrete arch, called Memorial Bridge, which was completed in 1925 over the Chenango within a few hundred feet of its confluence with the Susquehanna. During the flood all the bridges except this one of concrete were in danger of being washed away, and consequently were closed to traffic. This presented such a terrifying situation that the flood susceptibility of the Chenango became the compelling influence in determining the design of the new Ferry St. bridge.

Consequently the Ferry St. bridge as built consists of three 123½ ft. arch spans equal to the width of the clear waterway of the Memorial Bridge. Although a five-span layout was studied, the three-span bridge was found to be more economical and suitable to the conditions of the site. By reducing the number of arch construction operations in the river, the piers could also be stabilized more quickly to reduce flood hazards

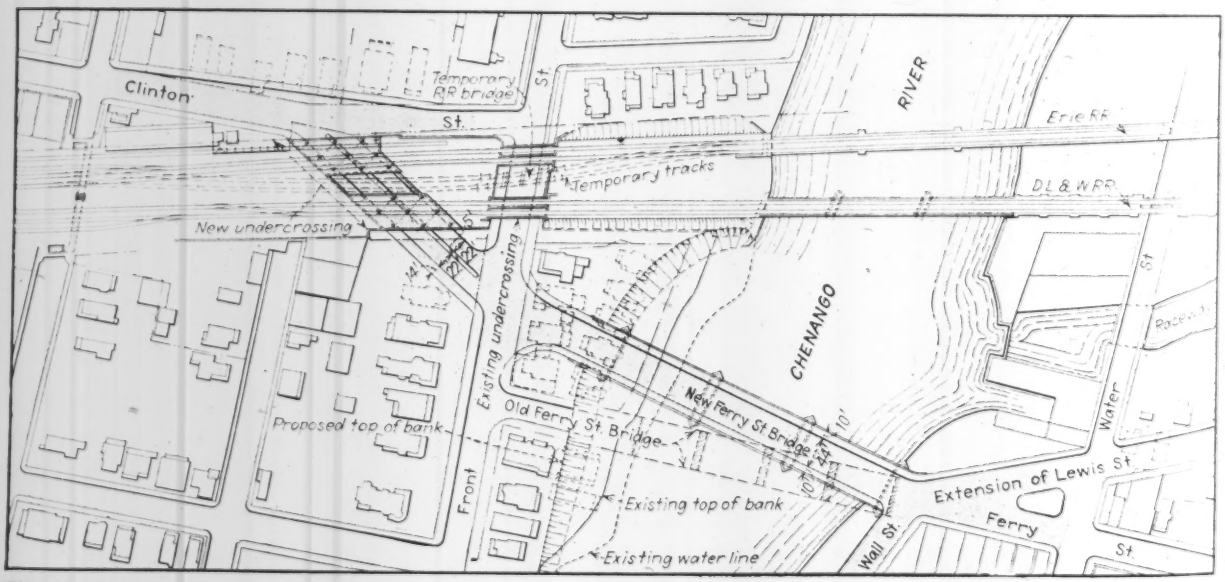


Fig. 2. Traffic between central city at right and the growing northwest residential and industrial area is greatly aided by the new Ferry St. bridge and the railroad underpass.

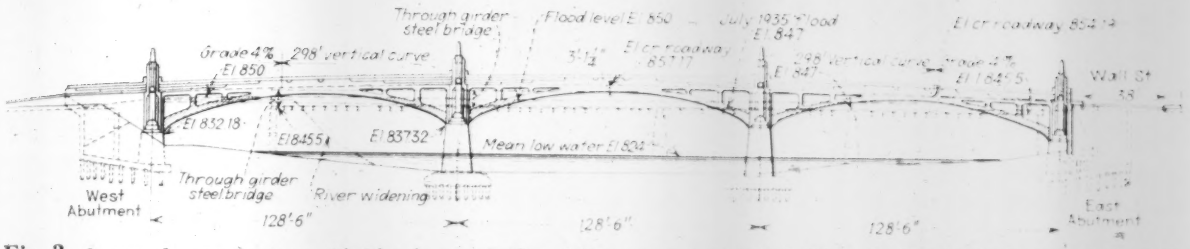


Fig. 3. Increased waterway is provided by the new bridge—9,650 as compared with 7,200 sq. ft. The hatched areas of the arch rings, which would be immersed at a flood level of el. 850, represent only 6½ per cent of the available waterway.

during construction. A full width barrel arch was adopted to obtain a shallow crown depth and thereby minimize the amount of grade change on the approaches in raising the roadway to secure additional depth of waterway.

The bridge carries a 44-ft. roadway and two 10-ft. sidewalks. Over the haunches of the arches an open spandrel floor construction proved to be more economical than an earth-filled arch for the span selected. Moreover, it provided additional waterway. The load curve of the partial open spandrel composition coincides, with little eccentricity, with the curve of a very flat arch. The smooth unindented surface of the intrados of the barrel arch and the boxlike openings formed by the rectangular floor slab with the transverse spandrel walls give little resistance to flood flow.

This concrete arch bridge is flood-proof to the extent of full immersion. To all intents and purposes it is a monolithic structure. The solid piers and buttressed abutments are supported on cast-in-place concrete piles, 232 under each pier and 204 under each abutment, driven practically to refusal to an average length of 20.9 ft. A 1-in. square reinforcing bar, 16 ft. long, embedded in each pile and projecting 4 ft. above the cut-off anchors the footing course of the piers and abutments to the piles. Additional lines of reinforcement continue from the footing courses through the piers, near their faces, to lap the reinforcement in the arch rings. This continuity, coupled with the weight of the structure spread over a firm wide base, assures a positive flood resistance and indestructibility.

Waterway provided

An unexpected value is also gained in the attenuated configuration of the bridge. This value, depicted in Fig. 3 where an outline of the old steel bridge is superimposed upon the elevation of the concrete arch bridge, relates to the advantage of the concrete arch in providing more waterway than the plate girder design with the same amount of grade change in the approaches. Incidentally, the I-beams shown suspended from the girders were installed to reinforce the floor with the advent of heavy highway loading.

The old bridge was washed away when the flood waters piled up against the face of the upstream girder to El. 847, 1½ ft. above the underside of the girders at the abutments. Although there would be a factor of safety in providing for a flood peak at El. 847 since the restriction in the waterway of the old bridge has been largely removed by river widening, it was deemed advisable to raise the flood clearance to El. 850. This flood level is 1¾ in. below the underside of the floor of the concrete bridge at the face of the abutments and is 5.5 ft. above the underside of the old girders. The floor depth of the concrete bridge is 1 ft. 10¼ in. Therefore, the roadway at the face of the abutment is at El. 852. This 5.5-ft. flood clearance above the underside of the old girder was accomplished by raising the existing roadway only 2½-ft. at the face of the abutment. If a through-girder bridge, carrying a 44-ft. roadway, were substituted for the concrete bridge, the depth of the floor would be approximately 4 ft., and the underside of a girder bridge at the abutments under the same roadway profile would be at El. 848.

At flood level 850, the area of the face of the concrete bridge immersed in the water, indicated by cross hatching, amounts to 625 sq.ft., or 6.48 per cent of the clear waterway of 9,650 sq.ft. between abutments measured from mean low water. The 625 sq.ft. is equivalent to 1.62 ft. depth for full width of the clear waterway. Therefore, the effective flood level for the concrete bridge is reduced to 848.38 as compared with clear flood level of 848.0 for a steel girder bridge carrying the same width of roadway.

The concrete bridge, however, would readily take an 850 flood on account of the additional opening above elevation 850, while the destruction of a steel girder bridge placed under the profile of the roadway of the new bridge would probably occur again before the flood reached this level. Finally the fact remains, that the concrete bridge is flood-proof to the extent of full immersion, which is of utmost importance in the event of some damming of the river by debris carried down by flood waters lodged against the face of the bridge. The jumbled position of the nearby railroad bridges might be a contributing factor toward this result.

Lines and grades

All elements of the bridge are formed concentrically with the 298-ft. radius vertical curve over the center of the structure and parallel with the short 4 per cent grade at either end. The over-all crown depth for the three spans is the same—3 ft. 1¼ in. This symmetry is fixed by the length of the vertical curve, the level center span, and by tilting the end spans to a 4 per cent grade along the springing line. The crown depth includes a 2 ft. 3 in. arch depth, 4-in. crown of roadway, ¼-in. waterproofing membrane, 3-in. concrete protection and a 3-in. bituminous pavement.

The extrados of the arches, for a length of 41½-ft. over the crown, was made flat to form the floor surface. The plane of this surface is in line with the deck of the 12-in. floor slab over the three 12½-ft. spandrel openings. Transversely, the floor slab is shaped to the crown of the roadway.

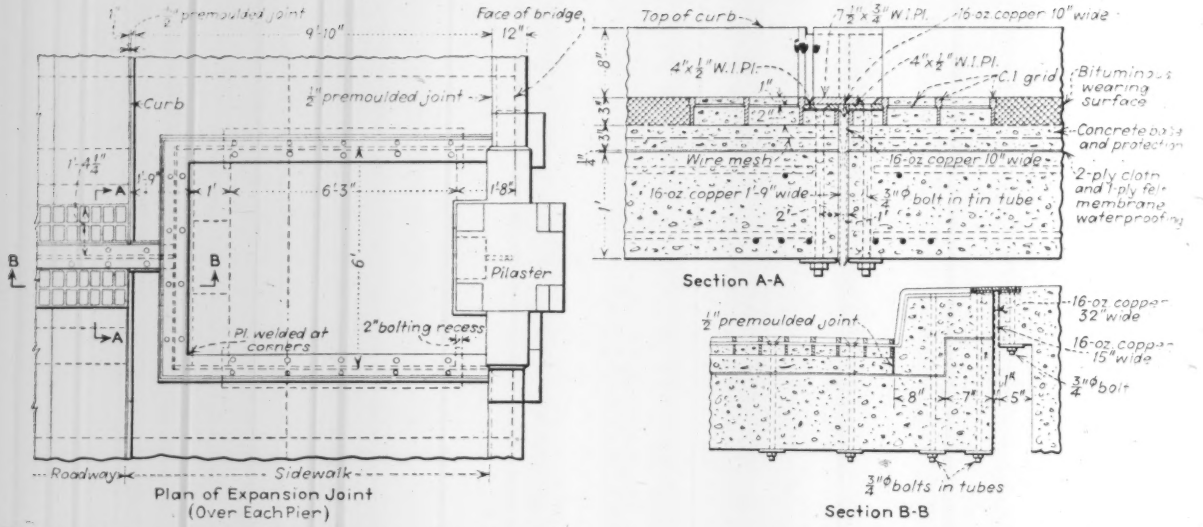


Fig. 4. **Details of expansion joints across the roadway and sidewalk over each pier. Unusual care was used to flash all concrete surfaces subject to seepage water with copper.**

Along the curb lines, the concrete protection was increased 3 in. in depth to form a concrete gutter 2 ft. wide. A ½-in. joint filler separates the concrete gutter and the curb.

The arch barrel extends for full width of the bridge for several structural reasons: (1) to provide space under the sidewalk to carry public utility lines and conduits; (2) to provide effective termination of the bridge floor waterproofing membrane; and (3) to eliminate an overhanging sidewalk which was considered dangerous in the event of being accidentally surmounted by a heavy truck. Since an accident of this kind is an infrequent occurrence, the floor slab under the sidewalk was reduced in thickness to obtain the greater depth of opening for the utility conduits by using allowable tensile stress of 24,000 lb. per sq.in. in the reinforcing steel and a compressive stress of 1,500 lb. in the concrete for a 20-ton truck load concentration.

Expansion provisions

An expansion joint in the superstructure was formed over the centerline of each pier by cantilevering the floor slab 3 ft. from the transverse spandrel wall. The cantilever joint offers no restriction to either horizontal or vertical movements of the floor. Every effort was made to make this joint watertight, but realizing that some seepage was bound to occur, all concrete surfaces of the joint exposed to such seepage were covered with 16-oz. sheet copper. This detail is shown in Fig. 4.

Across the sidewalk, the expansion joint is divided into two parts placed along the inner face of the transverse spandrel walls over the piers. A short longitudinal joint along the back of the curb connects this bipartite arrangement with the roadway joint. The sidewalk section thus enclosed and separately supported is rigid with the pilaster; both it and the pilaster are excluded from any movement of the bridge floor. The joints are set away from the pilaster as far as possible to preclude water seepage reaching the surface of this ornamental member.

The edge of the floor slab on each side of the expansion joint is protected by a cast-iron grill embedded in 6 in. of concrete placed over the waterproofing membrane. This grill acts as a seat for the roadway expansion joint plates, as a header to retain the pavement, and as an anchorage for the copper flashing which is laid between the fixed plates. The entire assembly is held in place by a staggered line of ¾-in. countersunk bolts, carried through the slab in tin tubes and bolted from the underside where they can be readily replaced or tightened. A crimp in the copper sheeting at the bottom of the slab forms a drip to prevent the water from reaching the bolts.

The waterproofing membrame is made up of two plies of saturated cotton cloth laid in three swabbings of a very high grade asphalt. This is covered with one ply of asphalt-felt cap sheet roofing applied to prevent abrasion of the membrane during construction operations.

The waterproofing membrane is carried over a 12-in. dike built integrally with the floor slab in line with the back wall of the curb, thence along the floor slab under the sidewalk area and up the parapet wall to be flashed in a set-back formed to receive the sidewalk slab. The waterproofing membrane covering the dike and the parapet offset make a good cushion for the curb and sidewalk slab. A ½-in. premolded expansion joint filler was placed against the parapet before the sidewalk was cast to absorb the sidewalk movement.

Foundations

The cast-in-place concrete piles, designed to carry 35 tons each were installed by first driving a 16-in. steel pipe with ½-in. wall thickness to proper penetration, with a steel cap over the bottom of the shell to prevent infiltration of soil and water. A corrugated pipe shell of 18-gage metal was next lowered into the driving shell and filled with concrete. With the weight of the hammer and driving ram resting on the concrete and corrugated shell, the heavy driving shell was then removed and reused.

The abutments are of a hollow buttress type, as shown in Fig. 5, with superimposed longitudinal and transverse walls forming cellular compartments and supporting a 14-in. floor slab. Before the floor slab

was placed, the compartments of the forward half of the abutment were filled with earth forcing the center of gravity of the vertical loads closer to the face, thus cutting down the length of the abutment by reducing the eccentricity of the resultant load when combined with the arch thrust.

Another feature in the foundation design is the reinforced buttress wall built at right angles to the abutment pilaster on the south side of the east abutment. This wall, averaging 27 ft. in height, is 75 ft. long and retains

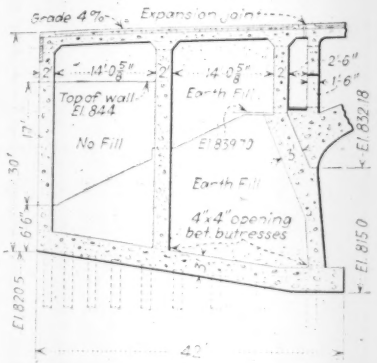


Fig. 5. Abutments of hollow buttress type with earth fill confined to forward half permit the use of a shorter abutment structure.

the roadway of Wall St. It is of the counterfort type supported on concrete piles to reduce depth of footings. To balance the overturning moment and to decrease the load on the piles, a slab 5 ft. wide was placed on the footings to carry only the vertical load of backfill over its width. This balancing slab, taking no upward pressure, is proportioned and placed to give a resultant vertical loading or reaction equally distributed over all piles of the T-shaped footing course. This slab and the wall are shown in section on Fig. 3.

Since heavy snows are prevalent in this territory, a snow hole 30 in. in diameter, was formed, and covered by a manhole in the center of the roadway at the crown of each arch. The cover plate of the manhole bears on a rubber gasket and is fastened securely to the frame by six ½-in. bronze cap screws. The opening through the arch ring is lined with 20-oz. copper sheeting which projects ¾-in. below the intrados to effect a positive vertical drip.

Three classes of concrete were specified: Class A (3,000 lb.) for

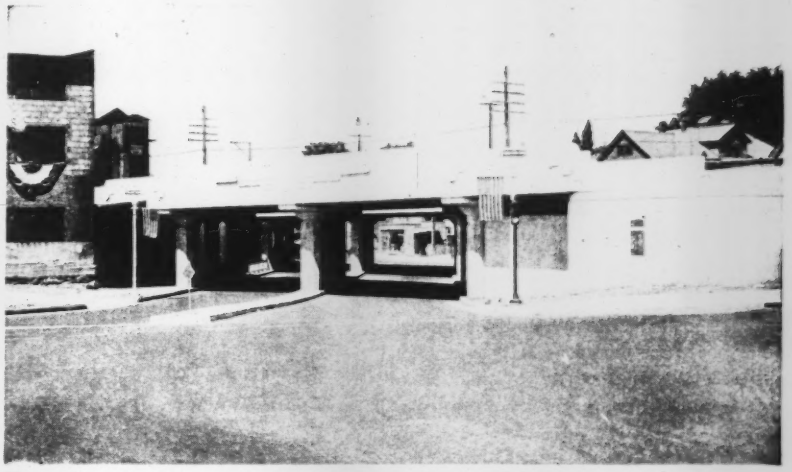


Fig. 6. Flat slab railroad underpass which forms an important part of the Ferry St. bridge project.

floor slab and spandrel walls; Class B (2,500 lb.), for all other parts excepting the pier footings and shafts, and abutment footings and buttresses, which were of Class C (2,000 lb).

A very interesting method of constructing the arch rings by suspending a full span structural steel centering from a small arch section built with the piers and abutments will be described in a subsequent article. A third article will cover the railroad undercrossing and describe the novel use of earth-filled steel sheetpiling cylinders used as piers for a temporary detour trestle.

Administration

Both river bridge and undercrossing were developed under the direction and supervision of C. A. Harrell, city manager and John A. Giles, city engineer. The plans and specifications were developed under the direction of the writer assisted by Messrs. H. K. Wilson, E. W. Benes, and Thomas Paterson, Jr., associate architect.

P. A. Page was special superintendant of construction and Mr. L. M. Darrow field engineer for the city. S. J. Sadow was resident engineer inspector for the P.W.A. Acknowledgment is here made of the splendid cooperation given by the office of A. S. Tuttle, state director of the P.W.A. under direction of L. G. Holleran, chief engineer and supervision of Barnet Kadin, assistant engineer.

The undercrossing was built by the Walsh Construction Co., Syracuse, N. Y., under the general supervision of H. H. Dugan and the river bridge by the James McGraw Co., Philadelphia under the general supervision of J. M. Harris.

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Insurance Cost Lowered By Improving Water System

FIRE INSURANCE PREMIUMS were lowered in Live Oak, Fla., when improvements were made in the waterworks system. This city of 4,000 population now has a second-class rating plus 5 and 10 cents. The improvements necessary to better the rating, according to an article in *The Water Tower*, consist of a 200,000 gal. elevated storage tank, several valves, fire hydrants, a quantity of 6- and 8-in. mains to complete the grid system in the business section, and a new 10-in. main leading from the plant to the grid.

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Municipal Airports Cost Money

REPORTS of 84 cities operating municipal airports reveal that 78 stood an annual operating loss totaling $1,039,936, not counting depreciation, principal or interest payments on the airport bonds, according to a nationwide survey conducted by the American Municipal Association. The average annual loss for the 78 cities was $13.332, while 6 cities showed an average operating profit of $551. During the past ten years, said the report, 738 cities have undertaken the operation of municipal airports.

Arthur N. Talbot Honored

University of Illinois gives his name to the materials testing laboratory in which his studies have been made

ARTHUR NEWELL TALBOT, dean of research in the civil engineering field, professor emeritus of municipal and sanitary engineering at the University of Illinois, was honored by the University on April 21 at a special convocation during which the Materials Testing Laboratory of the College of Engineering was renamed the Arthur Newell Talbot Laboratory. After Orville M. Karraker, of the university's board of trustees, made the formal announcement of the renaming, Prof. Talbot's work and influence was eulogized by President Arthur C. Willard and Dean M. L. Enger. Robert E. Doherty, Illinois '09, president of Carnegie Institute of Technology, concluded the ceremonies with an address on "Technology, Education and Social Welfare." More specific tribute was paid to Prof. Talbot's achievements in research and in developing young men in dinner addresses by former presidents Kinley and Daniels. Prof. F. E. Richart, Clarence L. Warwick, secretary of the American Society for Testing Materials, and F. E. Schmitt, editor of *Engineering News-Record*.

Arthur N. Talbot, though past 80 years old, is still active in research.

Testing laboratory at the University of Illinois named in honor of Prof. Talbot.

Arthur N. Talbot, born in 1857, graduated from the University of Illinois in 1881 and thereafter spent four active years on railroad location, construction and maintenance before returning to the University as assistant professor of engineering and mathematics. In 1890 he was appointed professor of municipal and sanitary engineering in charge also of theoretical and applied mechanics.

Contributions to research

Prof. Talbot's contributions to engineering progress have been so varied and extensive that it is difficult to do them justice in limited space. As was to be expected, his railroad work is reflected in his early research which included a study of transition curves for railroad track that led to development of the Talbot spiral, studies of rainfall and runoff and the related question of culvert and bridge waterways that brought other now well-known Talbot formulas. This period extended to about 1903. Outside of the railroad field it is probably best known for Prof. Talbot's studies on paving brick in which he devised methods for testing brick and developed means for interpreting test results.

Most of this work was so fundamental and so greatly needed that it was quickly absorbed into the art and its origin was forgotten.

Reinforced concrete

The middle period of Prof. Talbot's research work was centered on concrete and covered the decade ending about 1913. His first contribution to the rapidly developing art of reinforced concrete design was a classic series of beam tests. There followed tests of shear and bond, column tests, tests on large slabs, footings and the like. However, other subjects were not passed over in this period for it included one of his notable contributions to structural steel design, his tests on nickel steel riveted joints. Also included were tests on steel and wrought iron columns, brick and terra cotta piers and drain tile.

Paralleling and following the latter part of his work in reinforced concrete was a long study of proportioning of concrete.

Stresses in railroad track

Beginning in 1914 and still being pressed forward vigorously after nearly a quarter of a century, the joint study of stresses in railroad track sponsored by the American Railway Engineering Association and the American Society of Civil Engineers and carried out under Prof. Talbot's direction is on the same plane with his work on concrete.

For a full century railroad track had been developed by trial and error. Railroad and structural engineers felt certain that the rail was a beam, as well as an anvil, a column and a number of other things, but attempts to compute beam stresses in track rail were so grossly out of agreement with the facts as to appear to prove that nothing could be done about track by scientific methods.

Undeterred by the failure of others, Prof. Talbot schemed out means and instruments of investigation. He had the courage to put delicate little in-

struments, that could measure fractions of a thousandth of an inch, directly under the thundering hammer blows of locomotive drivers. He assembled, trained and inspired a group of other keen minds that worked under his direction, and together they obtained results. Step by step, always making further progress, tracing out his course logically by beginning with the most measurable and readiest part of the structure first and going forward in due progress to the more elusive and refractory ones, he sketched out in minute detail the whole story of what happens in track, and why, and incidentally the reasons for the failure of earlier attempts at scientific study.

Even this prodigious rail investigation did not absorb the full Talbot energy. In the same period he developed the void theory of concrete strength, one of the classic fundamentals of concrete knowledge. He studied mixer action, made tests of concrete buildings and flat slabs, studied flow through hose and valves, investigated the strength of cast iron, and developed many by-product studies of the rail and track investigation.

There is one other phase of Prof. Talbot's activities which is not as widely known as it should be; that is his service on technical committees, particularly on the joint committee on concrete and reinforced concrete. In the early work of the committee just named he was the chairman of the sub-committee on plan and scope. As such he had an important influence in charting the course and direction which the work of the committee should follow. He was also chairman of the subcommittee on design. Outside the plan and scope subcommittee, the subcommittee on design was without question the most influential and important phase of the joint committee work and was largely responsible for the satisfactory completion of the main report, a fact which is duly acknowledged in the final report.

The work of Prof. Talbot on committees and on the governing boards of technical and professional societies extended very materially the influence of his research work. Another important aspect of his research has been the training in orderly methods and logical, precise thinking which he has given to his many graduate students.

Measuring Bin Wall Pressures Caused By Arching Materials

J. R. McCalmont

Assistant Agricultural Engineer, U. S. Bureau of Agricultural Engineering

Method involves transferring pressures to point loading on calibrated bars and measuring their deflections

A NEW METHOD of measuring pressures of coarse materials has been developed by the division of structures of the Bureau of Agricultural Engineering, and used for measuring the loads developed by ear corn in cribs and silage in silos though the method is applicable to other conditions such as in bins. Pressures exerted by such materials are not uniform, due to the unit parts of the mass interlocking and causing a bridging or arching action. Differences in the formation and distribution of the arches cause erratic variations in the pressure on the vertical restraining walls. Therefore, the larger the surface on which pressures can be measured the greater the accuracy of the results.

When the study of pressures exerted by ear corn in cribs was first undertaken by the bureau, a crib 8 ft. wide, 16 ft. long, and 24 ft. high, was built to study the loads on the different structural members, especially the outward and downward pressures on the studs. The strain gage method was tried, but discarded since it was impracticable to separate the distortion caused by bending stress from that caused by the column stress due to the load supported by friction on the walls of the crib, or to accurately determine the distribution of the horizontal pressure. The panel and calibrated bar method described herein overcame these difficulties.

In this method the load on a large panel or wall section is transferred to two bars (Fig. 1C), one at either end or side of the panel and to two points on each bar, (Fig. 1A) which can be shifted according to the size of bars and the magnitude of the load to control the amount of deflection, which is read over a given gage length at the center of the bar by a

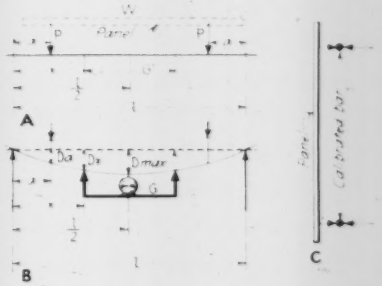

Fig. 1. Load and deflection diagram for calibrated bars.

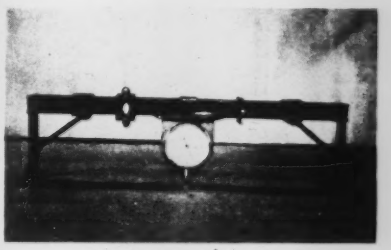

Fig. 2. Instrument used to measure deflections on calibrated bars.

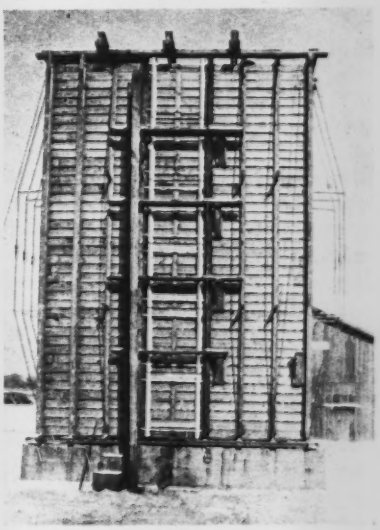

Fig. 3. Test crib equipped with calibrated bar panels for measuring deflections.

special deflectometer and is a measure of the load on the panel.

For the purpose of selecting the proper size of bars to support a given size of panel, it is necessary to use familiar formulas for a beam having this type of loading. Fig. 1 shows a load and deflection diagram of such a beam. The maximum safe load would be $2fs/a$ where f equals the allowable fiber stress; s, the section modulus; and a, the distance from the points of loading to the points of support. To compute the probable deflection over the selected gage length at the center of the beam and the maximum movement to be allowed the panel it is necessary to use the formulas for maximum deflection $\frac{Pa}{24EI}(3L^3 - 4a^2)$; deflection at point of loading, $\frac{Pa}{6EI}(3La - 4a^2)$; and deflection at a point between the loads, $\frac{Pa}{6EI}(3Lx - 3x^2 - a^2)$; where P is the weight of each concentrated load; L the length of the beam in in.; E the modulus of elasticity; I the moment of inertia; x the distance from point of support to any given point between the loads.

Since the conditions within the mass exerting the pressure should be as near as possible to actual storage conditions, the movement of the panel that transfers the pressure to the bars should be as small as possible. With this in view the value of a in Fig. 1 should be as small as will give the necessary difference between the maximum deflection and the deflection at x, to control the human error in taking deflection readings and to keep the percentage of error small. The bar represented by the loaded beam in Fig. 1 is calibrated in a standard testing machine by applying known loads to the bar under the same conditions of loading and support as will be used in the field and reading the deflection over the selected gage length at the center of the bar.

The difference between the maximum deflection D_{max} at the center and that at two points equidistant from the center D_x, which corresponds to the gage length selected, is the amount of deflection the instrument will have to register and must be within its limits. The readings are taken to the nearest 0.0001 in. with the deflectometer indicated by G in Fig. 1 and illustrated by Fig. 2. It is equipped with level glasses fixed in planes vertical and horizontal to the knife edges of the instrument to allow measuring both the vertical and horizontal components of forces acting on the bars. Since the stress-strain diagram of steel is a straight line curve below its elastic limit, the increment of load causing unit-deflection is constant and the actual load on the bars when in use is found by multiplying the deflection reading obtained with the instrument by the calibration constant.

This system of measuring pressures can be applied to a wide variety of conditions by building the panels and the bar supports to suit the conditions at hand. It can also be used to measure concentrated loads applied to beams, by calibrating such beams under actual conditions of loading and support. The following brief description of the setup used to measure the forces acting on the walls and floor of a corn crib illustrates how the calibrated bar method may be applied.

Vertical sections of the walls of the crib, approximately 3½-ft. wide, were removed at the corner of the structure, Fig. 3. The only connections between the two end sections of the crib were a 4 x 8-in. timber plate at the top and a 3 x 3 x ⅜-in. angle at the bottom. Later two double channels were placed across the ends of the crib at a point 8 ft. from the floor and tied together on either side of the crib with 1-in. round rods to prevent spreading due to deflection of the end studs, as any spreading would increase the width of the opening at the center of the crib and change the bearing points of the panel supports.

The walls were then completed by setting in the pressure panels (3½ ft. wide by 4 ft. high) as shown in Fig. 3. Each panel was made of 1 x 6-in. cribbing nailed to 2 x 4-in. cross pieces bolted to 4-ft. sections of 3-in. I-beams. (Fig. 4.) The panel was supported in place by 1⅛-in. heat-treated steel bars. The bars passed through holes near the top and bottom of the panel I-beams and rested in 1¼ in. holes in the webs of the 7-in. I-beams used as studs. The ⅛ in. of play in the supports allowed the steel bars to come to good bearing at the four corners of the panels. Pressure against a panel caused deflection of the steel bars which had previously been calibrated in a standard testing machine, with bearing and load points placed at the same distances as in the crib. The sum of the deflections of the two bars supporting each panel was therefore a direct index to the pressure on the panel.

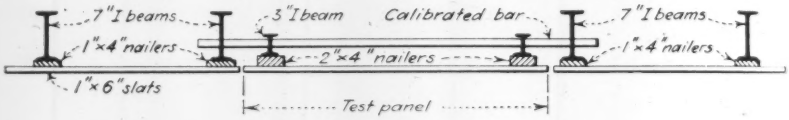

Fig. 4. Plan of wall of test crib showing test panel details.

The deflections of the calibrated bars supporting the wall panels were measured by the special instrument shown in Fig. 2 in both the horizontal and the vertical planes to the nearest 0.0001 in., and readings could be repeated with a variation of less than 0.0005 in. Since a deflection of 0.0001 in. corresponded to a load of about 2 lb. on the bar, and the pressure area supported by a pair of bars was 14.0 sq. ft. the reading was accurate to within about 1.5 lb. per sq. foot.

Panels for measuring floor load were 24 x 43 in., and only vertical deflections were read.

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Government Spends $61.24 For PWA Man-Month

PROVIDING one man with a month of regular employment through the PWA program costs the federal government $61.24, according to a study by the Bureau of Labor Statistics. This amount covers both the direct labor at the construction site and the indirect labor created in regular industrial employment because of PWA material orders, the study shows. This amount is based on the 45 per cent contribution by PWA towards the cost of non-federal projects. The balance of the cost (55 per cent) or $74.84 is paid for by the communities which are using PWA funds.

FIG. 1. A MONTANA ROAD AS IT APPROACHES PRICKLY PEAR CANYON IN GOING FROM HELENA TO WOLF CREEK

Safe Fast Roads at Small Costs

W. O. WHIPPS

Administrative Engineer and Secretary, Montana Highway Commission, Helena, Mont.

Third in size of 48 states, with sparse population, long roads and little money, Montana achieves high standards in safe roadbuilding

The wish to travel fast seems to be most active in the wide open spaces. Reports from all the states disclose that road design for 100 mi. speeds is most common in those that have long roads and sparse population and therefore must spread their highway money very thinly. And they are doing it with such remarkable success that road travel at 60- and 70-mi. speeds is easy and safe and common. Montana is one of the states, and what it is doing is told with an interesting personal touch in the following article. — EDITOR.

WOULD it interest road engineers in eastern states to know how the third-largest state, which has few people and not much road money, manages to get safe high-speed roads? It is quite a different experience from that which they know. Yet if what we hear in Montana is so, the East needs more road money as badly as we need it; there is then one thing in common between say little Rhode Island, about which Chief Engineer Kiely wrote so interestingly in *Engineering News-Record* of Apr. 14, p. 543, and big Montana. But let us get back to roadbuilding at small cost for safe fast motor-vehicle travel in Montana.

Due to its large area and sparse population (Montana is the third largest state in area and has a population of less than 600,000 persons) the problem of providing adequate highway transport is a huge one. We have long roads (it is 700 mi. across Montana from east to west) we also have much mountain land, including the main range of the Rocky Mountains, over which it is exceptionally difficult and expensive to build. And we have a very limited revenue for highway purposes. The task is to make funds stretch to the limit and thereby secure the greatest possible mileage of dustless and smooth-riding surface, with easy grades and light curves, over which the modern motor vehicle may safely travel at high speeds.

Under these conditions it was early realized that the state could not afford any appreciable mileage of high-type pavement such as portland-cement or asphaltic concrete, and that it must develop and use some lower type of surface which yet would provide adequate service. Therefore, through the end of 1937 the state has constructed about 4,100 mi. of highways with the lower and intermediate types of bituminous-treated gravel surface. By treating the local crushed rock or gravel with a bituminous road oil, using either the penetration method, road-mixed bituminous surface mats of varying

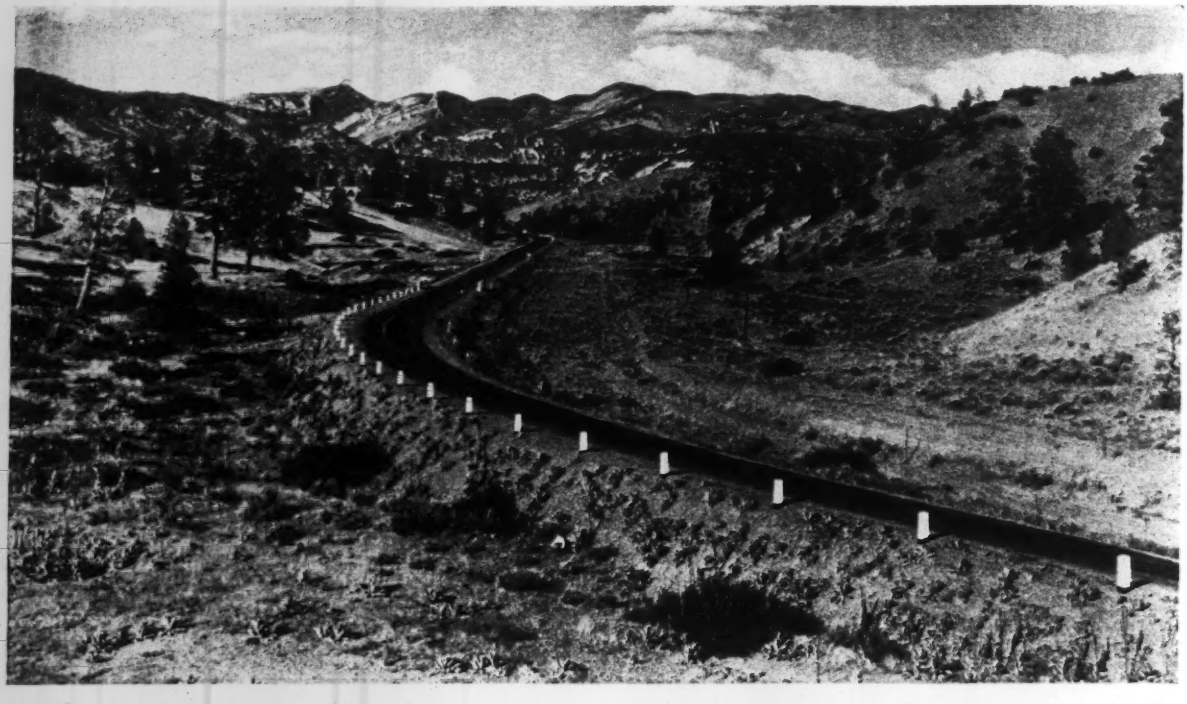

Fig. 2. A Montana road entering Limestone Canyon the Gate of the Mountains named by Capt. Meriwether Lewis in 1805 when the Lewis-Clark expedition entered the mountains

thicknesses or plant-mixed mats of oiled surfacing material, this mileage has been secured at only a fraction of the cost of the higher type pavements. The present policy is to complete the entire trunk highway system to this standard as one objective; the other being to reconstruct sections of highways which now have an oiled surface, but where the grade line was originally built entirely too low, and where the curvature and grades are below present-day design standards.

Safe high speed the goal

Traffic control and safety, in Montana, exhibit as elsewhere, a dual phase. Mechanical means of providing for the safety and control of traffic are administered by the highway department under maintenance. They include the installation of warning, marking, informational, directional and distance signs; the center line striping of the highways; the removal of slides and other obstructions; repairing washouts, and other similar items. The patrolling of the state highways and the exercise of physical control over drivers thereon is administered by the Montana Highway Patrol, a uniformed body of about fifty patrolmen under the command of a supervisor. The patrol enforces traffic laws and regulations, makes arrests when necessary and performs the other customary duties of a highway patrol. The patrol is administered and controlled by the Montana Highway Patrol Board, which is by statute the same body as the Montana Highway Commission.

But these are not all its duties in assuring safe travel as the highway department thinks of them. We have definitely raised our standards for securing right-of-way. Our standard minimum for right-of-way is now 100 ft., except in unusual cases where costs are exorbitant or in cities or towns where improvements and developments already made will not reasonably permit. We believe this is an ultimate economy and that the wider right-of-way generally promotes the safety features we are trying to build into our highways.

We are also constantly increasing our standards of road design. Some of our present completed highways have only a 21- or 22-ft. wide grade with an oil surface mat from 18 to 20 ft. wide. This makes the traffic lane only 9 to 10 ft. wide, which is not sufficient for present-day traffic, particularly the narrower width of 9 ft. We consider the three-lane highway more of a menace and danger to traffic than the two-lane highway of adequate width. Accordingly, in our new design of main roads we are providing for a grade 30 ft. wide with a 24-ft. oil mat and 3-ft. shoulders on each side. This gives a traffic lane of 12 ft. and eliminates a tendency to crowd the center line.

We are designing now in other ways to provide for additional safety, such as providing for increased sight distance on both horizontal and vertical curves; reducing curvature and straightening alignment when possible, even at some expense in having heavier grades for short distances; requiring flatter side slopes with broad and shallow borrowpits; providing turnouts for scenic views, or for safety spots for parking off the highway, and specifying an increased depth of subbase material for stabilization and to combat capillarity, so destructive to oil mats.

Our main trunk highway system, which in Montana is the same as our federal-aid or seven-per cent system, includes about 5,450 mi. By the end of 1937 we had improved about 4,850 mi. of this system, leaving 600 mi. still for initial improvement. Of this 4,850 mi. we have about 4,125 mi. of roadway provided with a bituminous gravel or a higher type such as portland-cement concrete, the latter mileage being about 37. The remaining improved mileage is either graded or surfaced with untreated gravel. Our construction contract program for 1937 totaled about

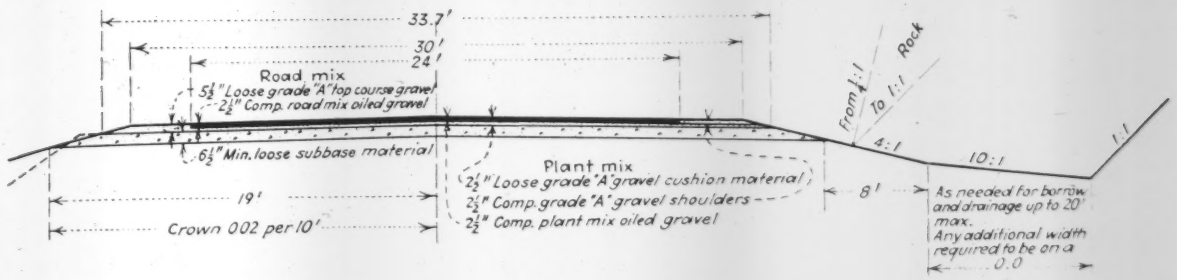

Fig. 3. A standard section of a Montana 30-ft. roadway as these roads are now being constructed

$5,000,000 and is the smallest we have had for several seasons, due to the almost complete cessation of federal emergency grants for roadbuilding. Our total construction investment in improved state highways is about $75,000,000.

The design and construction of bridges and railway grade-separation and other structures is proceeding along the same lines as is our road design and construction. We are constantly working toward the ideal of increasing the safety factor here as elsewhere. We are now designing many of our bridges so that the roadway width of the bridge is the same as the width of the road grade at the bridge ends, so as to avoid any constriction of traffic when passing onto the bridge. This principle is being generally applied up to spans of 150 ft. As rapidly as possible we are eliminating the narrow bridges which now exist on our main highways. We are building much heavier handrails for our bridges to withstand greater impacts and we are also setting the handrails farther back from the curbs at the side of the bridge roadway to eliminate the possibility of motor vehicles sideswiping the rails.

The maintenance of our completed state highways becomes increasingly more important each year as construction progresses. It is handled through a maintenance branch of the highway department at the general headquarters in Helena, operating in conjunction with the equipment division and ten field divisions. Each of the ten field divisions includes several adjacent counties of the 56 counties in this state, and each division now handles an average of more than 450 mi. of maintenance.

Through maintenance operations a constant endeavor is made to keep all roads in the best possible condition for the traveling public, service and safety for traffic being the objective. Our general maintenance operations, including normal and routine maintenance items, is costing now an average of about $231 per mile. Special maintenance and betterment operations, including the raising of grades, addition of more subbase, reconstruction of old oiled sufaces, improving alignment to aid visibility, replacement of gravel surfacing lost through traffic and climatic action, and many others, add nearly the same amount per mile per annum to maintenance costs. Our budget for the present fiscal year for maintenance is about $2,100,000 or more than 45 per cent of our total revenue.

Snow-removal operations constitute in Montana a maintenance activity with which some states are not confronted. During the winter period we keep our highways open as continuously as possible, and plow the snow off after each snow-

Fig. 4. Harding Way, south of Butte, a section of U. S. Route 10

fall. Present-day traffic demands, and we believe is entitled to, this snow-removal service.

We have an original investment of about $3,000,000 in equipment, most of which is used in maintenance operations. Among the major items of equipment are: 284 light trucks, 74 four-wheel-drive heavy trucks, 19 two-wheel-drive trucks, 117 motor patrols, 139 pulltype graders, 14 rotary-type snow plows, 57 V-type snow plows, 108 one-way plows, 4 power shovels, 15 road-oil distributors, 3 gravel-crushing plants, 30 tractors, and numerous other items too diversified to mention in detail. An equipment division supervises the operation and repair of the equipment and reports to the maintenance department. Repair shops are located at general headquarters in Helena and at the field division headquarters. Items of equipment are constantly being replaced and renewed, and all purchases are made through the state purchasing agent upon advertisement and competitive bids, and in conformity with specifications prepared by the equipment division of the highway department.

The Montana highway department is administered by a three-member highway commission appointed by the Governor of the state. This is a per-diem commission meeting only a few days each month. The commission appoints a state highway engineer, who is the engineering operating executive, a secretary to handle commission business and general administrative matters and other necessary engineering and administrative employees, the choosing of minor employees being delegated in practice to the operating executive. The commission is a policy-making body which makes decisions and outlines general programs, the carrying out of which is handled by the full-time executive employees and department and division heads under them. The engineering section is divided into three main departments, preconstruction, construction and maintenance, while the administrative section has mail and filing, accounting, federal-aid relations and the other usual functions.

The only source of state revenue for the department is the net income from a 5 c. per gallon state tax on gasoline, which is at present developing revenue of about $4,500,000 per year.

FROM FIELD AND OFFICE

Working problems and time-saving methods . . . Edited by Charles S. Hill

Vertical-Lift Wall Map

An 18x12-ft. pipe-line map in the Los Angeles water department has been arranged to slide up and down by electric power so that any part can be brought quickly into position for close inspection from the floor. The illustration shows one end of the map and rail in front which when rotated actuates the motor that moves the map up and down. The map on cloth is mounted on a wood frame or panel that consist of 12-in. boards placed transverse to vertical uprights made of hardwood to which the boards are bolted. The map proper is mounted on cloth which passes around a smooth curve at the top of the frame to a fastening behind, thus the weight of the map is properly suspended from the top. To give desirable tension and to keep the map surface in a vertical plane, short sections of lead pipe are placed in a hem of the mounting cloth along the bottom edge. A ½-hp. motor geared to a sprocket drives a chain running the full height of the map panel; limit control switches cut off the current when the panel approaches the limit of travel either at the top or bottom of the run. The weight of the map and its mounting is counterbalanced by two weights which move up and down in 5-in. pipes supported vertically at the sides of the panel. These pipes carry the vertical rails engaging double-flanged wheels attached to the panel at the corners to guide it as it moves up and down like an elevator.

Wall map at a twist of the railing slides up or down to suit the observer's vision.

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Fast Tape Calibration

GEORGE D. WHITMORE
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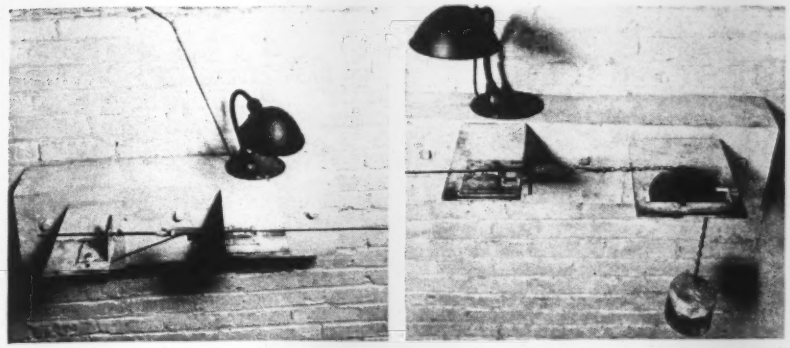
A dozen field tapes a day are being calibrated with a master tape by one man by the device illustrated in use in the Maps and Surveys Division of the Tennessee Valley Authority. The device consists of two brackets, set 100 ft. apart, on the inside of a brick-building wall, at about chest height. In the illustration A is the rear bracket, or zero end, with its calibrating mark fixed in place and B is the forward bracket, at the 100-ft. end of the tape, with the calibrating mark attached to a vernier with slow-motion screw. The zero and 100-ft. calibrating marks are etched on a thick piece of glass, having the top surface ground to an arch shape, the flat bottom surface being silvered. Thus errors due to parallax are eliminated if the mark on the tape is brought into exact coincidence under a magnifying glass with both the etched line on the top of the glass and its reflection on the bottom mirrored surface.

The master tape of invar, 100 ft. long, precisely standardized by the National Bureau of Standards is suspended over the zero mark of the rear bracket, A, using a tape clamp as illustrated. The zero mark of the tape is brought into exact coincidence with the zero mark on the mirror, slow motion being obtained by means of a wing nut running on



Zero and 100-ft. vernier arrangement for calibrating field tapes with master tape.

the threaded hook. The 100-ft. end of the tape is attached to a 20-lb. weight, which is suspended over a frictionless pulley. After the zero mark of the tape is brought into exact coincidence with the fixed mark on the rear mirror, the vernier at the forward end is slowly moved until the graduation on the forward mirror comes into exact coincidence with the 100-ft. mark on the tape. The vernier is then read to the nearest 0.001 ft., and the temperature read on calibrated thermometers to the nearest degree.

The master invar tape is then removed, and the steel field tape is suspended over the brackets in a similar manner and the vernier and temperature read. The difference between the two vernier readings gives immediately the difference between the lengths of the two tapes; having the precise difference between the lengths of the two tapes, the application of this difference algebraically gives the over-all absolute length of the field tape.

The steel tape is then carefully weighed, and its cross-sectional area determined by micrometer measurements. From these data, a chart or table is prepared which gives the absolute length of the field tape for any and all other conditions of support and tension, and for any fractional part of the full length.

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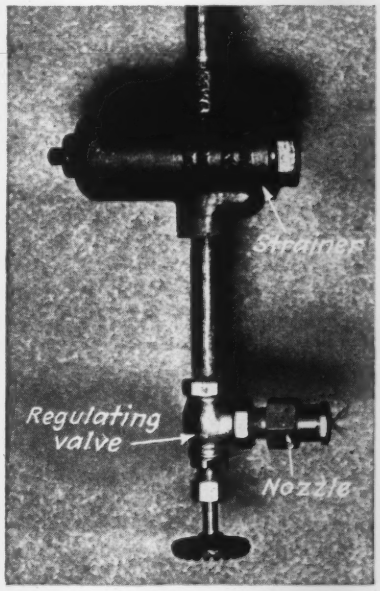
Moist-Room Spray Nozzle

R. W. ABBETT
Union College, Schenectady, N. Y.

A spray nozzle developed for the particular purpose is giving excellent moist-room conditions at the new concrete curing unit for Union College laboratory. This device is of particular interest because of its low cost and easy installation compared with the usual moisture control devices, of which there are three. The desirable dense fog inside the moist room has been obtained satisfactorily by dripping water on a motor-driven rotating disk in the laboratories of the U. S. Bureau of Public Roads. Compresed air atomizers, as recommended by the Portland Cement Association, are widely used. Other laboratories have adopted the type of control used by the New York state highway department, in which water is allowed to cascade down the walls and is collected in troughs at floor level and re-circulated by pumping.



Spray nozzle assembly for concrete curing moist-room.

It was recognized that much could be gained in simplicity and cost reduction if a nozzle operating under hydrostatic pressure only could be developed to produce the proper quality and distribution of spray. Through the cooperation of the Anthony Company, manufacturers of oil and tar spray equipment, such a nozzle was developed and tests indicate a suitable quality of spray at all water pressures from 25 to 100 lb. per sq. in. The distribution remains practically constant throughout this pressure range. One nozzle discharging horizontally from one end was sufficient to fill the 3½x12 ft. x 7 ft. 8 in. room at Union College with a fogging spray of uniform density.

Since the orifices in this nozzlze are extremely small it is necessary to use a metal gauze strainer to avoid stoppage by small particles of dirt and rust scale. A needle valve to regulate discharge is also desirable. The total cost of the nozzle, nozzle holder, strainer and regulating valve is less than $20.

The rating curve for the nozzle indicates that it discharges about 11 gal. of water per hour at the maximum pressure of 100 lb. per sq. in.

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Bridge Curb Form Support

Where the curb and sidewalk of a bridge are poured integrally with the concrete floor slab, support of the curb face form is often troublesome. On the bridges that carry the new U. S. Route 30 highway cutoff through northern Indiana the sidewalk is a thickened section of the floor. Here the contractor, J. C. O'Connor & Sons, Ft. Wayne, handled the form problem nicely. The cone and bar system of form tie was used throughout, and to support the curb face form, which was simply a 2x8-in. plank, sets of two cones, placed back to back and joined by a short bar section, served as chair supports for the curb form, as shown in the accompanying illustration. The chains remain in the concrete. The form was supported laterally by the conventionl tie system.

Two cones and short bar provide chair supports for bridge curb form.

Fault Noises Studied As Possible Earthquake Warnings

WM. D. PATTERSON
Hydrographic & Geodetic Engineer, U. S. Coast & Geodetic Survey

Sounds originating deep down in California's fault zones are being explored in search of advance indication of seismic disturbances

DURING the past winter sounds have been heard by listening devices deep underground at fault zones in California. The nature of the noises is still conjectural, but they are believed to be resultants of very slight movements in the earth's crust caused by internal stress of the kind that, when sufficiently large, produces an earthquake. These sounds may, in fact, be forewarnings of coming seismic movements. They are being studied continuously with a view to throwing light on this question.

"Fault-murmur hypothesis" is the theory that vibrations, presumably of sonic or supersonic range, originate in active earthquake faults. If such sounds are indications of the stress that precedes seismic movement then some interpretation that would give warning of impending earthquakes may be possible.

Geophysical prospecting parties in California repeatedly have recorded sustained vibrations which they could explain only by the fault-murmur hypothesis. The possibility of getting useful information about these fault murmurs was discussed last year by interested engineers; in October a joint committee formed in San Francisco, arranged a cooperative program of sound studies along fault zones. Observations have continued through the winter months.

Organization

The joint committee in San Francisco represented the local section of the American Society of Civil Engineers, the Seismological Society of America, and the U. S. Coast & Geodetic Survey. Funds for necessary expenses were donated and the U. S. Coast & Geodetic Survey furnished trained personnel together with such listening apparatus as was available on the Survey's ship "Guide," which wintered in San Francisco Bay.

Reconnaissance began with a small field party, the objectives of which were: (1) to determine whether noises could be heard, after suitable amplification, along the faults; (2) if so, to get some indication of their volume, vibration frequency, and frequency of occurrence; and finally (3) to select suitable locations for continuous recording.

For the first several weeks the field work produced only negative results. Microphones were put down in shallow holes along the San Andreas rift, hydrophones were lowered to the bottom of lakes on faults and piezo-electric pick-ups were placed on bedrock outcroppings. It was found that shallow holes in dry earth were useless, as a grain of sand dropping on or near the sound unit made a loud crash in the ear phones, and wind in nearby shrubbery or a hand touching a blade of grass near the hole caused disturbances. On the lake bottom, the sound of distant centrifugal pumps, water movement in tunnels, and even the waves lapping distant shores, assumed major proportions. No sounds were heard that could not be ascribed to known causes. In settled areas traffic disturbances blotted out other sounds.

This early experience suggested the use of deep, unused wells near faults in isolated localities. Several of these were tried; they proved to be by far the most satisfactory listening posts.

One of the best listening posts (No. 1) is a well 360 ft. deep with water level 30 or 40 ft. below the top. In the upper 200 ft. the casing is 12 in. in diameter; below that point, 8 in. Through a hydrophone in the bottom of this well were heard the first of the faint, grinding noises with intermittent and relatively loud rumbles and crashes, which are believed to be of fault-zone origin.

Development instruments

At the outset no one knew what type of listening apparatus would be most suitable. It was presumed, however, that vibrations would be in the supersonic range. Fortunately a considerable variety of equipment for sound detection was available on the "Guide," including carbon, dynamic, magnetic and piezo-electric vibration pick-ups (microphones), some of which were in sealed cases for use under water. Although no recording equipment was available it was apparent from the start that nothing less would be adequate; only in records of variations in the noises from day to day and from week to week would it be possible to collect data useful in establishing the essential relationships. However, before going to the expense of making such apparatus it was decided to determine by test which microphone types were best.

Carbon units were unsuitable because the large amplification necessary made the carbon "hiss" objectionable. Also, carbon units produced variable reception under different conditions. Dynamic and magnetic units were satisfactory and the piezo-electric vibration pick-ups were particularly so. The sound-powered magnet type responds to a wide range of frequencies (second only to the piezo-electric) and is as sensitive as any. Because it has the advantage of being much smaller than the piezo-electric, and can be used in the small watertight cases required for deep wells of small diameter, it was adopted as standard.

Alternating current amplifiers were found preferable, but direct current from storage batteries was best for a 46-decibel booster (with non-microphonic tubes) used at the well top. This booster is required to get the amplification necessary to prevent radio and other disturbances from being picked up by the shielded cables connecting well top and am-

Fig. 1. Amplitude of the pen movement on the recording chart indicates loudness of sound picked up by a microphone 300 ft. underground.

plifier. The amplifier unit, housed as close to the well as possible, was finally arranged as a 120-decibel direct-coupled a.c. amplifier and recorder. Full shielding of cables and tubes is necessary to keep out surface noises.

Continuous recording

To provide a continuous recorder without incurring prohibitive expense, a portable automatic tide gage was adapted to meet requirements. This gage has a drum 6 in. in diameter and 7 in. wide operated by a spring motor timed for one turn in 48 hr., i.e., a paper movement of 13/32 in. per hr. By use of a counterweight-operated worm screw the stylus is made to advance as it spirals around the drum; seven complete turns are made at the rate of one turn per 48 hr. This provides a 14-day record without overlap. Standard waxed tide-gage paper is used, ruled to measure time in 10-min. intervals. Since the amplitude of stylus movements is proportional to the volume of incoming noise, variations in the sound from day to day are shown by the width of the pen's movement. Sudden bursts of energy are shown by one or more lines of maximum or nearly maximum amplitude.

Much time was spent developing details of the recorder, adapting to it the most suitable hydrophone unit and getting the assembly to work well. Since this was completed (about the middle of December) records have been continuous.

Two deep wells near the Hayward fault were found to have different characteristics. Recording instruments identical in design and construction showed surprising differences in these two listening posts. To reach a recordable sound level, sounds at post No. 2 required 10 to 20 times the amplification needed at post No. 1. Oscillograph records taken at each station (using the extra amplification required at No. 2) showed the continuous noise records to be very similar in frequency and general appearance. The bursts of energy which, when heard in the ear phones, resemble crashes and rumbles, occur only at intervals of several days at post No. 1; at No. 2 they occur at two- to five-minute intervals in all records.

After several weeks of observations at both listening posts, the hydrophone at No. 1 was raised to the 200-ft. level and there operated for several days. At this depth the noise level was much lower than at the 260-ft. depth in post No. 2. When the hydrophone was again lowered to the bottom of the No. 1 well (360 ft. deep) the noise level was, as formerly, several times greater than at No. 2. This establishes the fact that the noises increase with depth, indicates that they are not of surface origin and tends to confirm the belief that they have their origin in earth strain. The significance of the daily and weekly variations is as yet unknown, but it may be stated that these variations have no correlation with time of day, as they probably would have were they of surface origin.

Similar recorders are to be installed in other wells along faults and also in one or two wells away from any known faults, to serve as "control" records.

Conclusions

No earthquake has occurred on the Hayward fault since observations began and hence results are as yet inconclusive. Data are too meager to be taken as the basis for definite conclusions; additional investigations are needed. However, progress thus far indicates that stress and strain along an earthquake fault produce both continuous and intermittent noises (the latter of greater intensity), which vary in volume from day to day and from week to week and which can be recorded continuously.

With the approach of the "open season" for oceanographic surveys the "Guide" will go out on sea duty and it will be necessary to defer some of the work until next fall. However, it is hoped that some of the continuous records can be maintained through the summer season.

In these studies, the San Francisco joint committee already referred to, consisted of Commander R. R. Lukens, U. S. Coast and Geodetic Survey, H. M. Engle and N. A. Bowers. In addition to the contributors mentioned, Capt. R. V. Labarre, Los Angeles, not only supplied funds but gave material aid in organization. Other active cooperators were Perry Byerly, David Hendrickson, Prof. George D. Louderback, and Frank Rieber. A. M. Vincent, senior chief radio operator of the "Guide" did all instrumental work and has earned special credit for ingenious instrumental design and construction. The author had charge of the field work as a whole.

BOOK NOTES AND REVIEWS

The month's additions to the engineer's reading and reference list

Keeping Cost Records

ACCOUNTING PRINCIPLES FOR ENGINEERS—Second Edition. By Charles Reitell and Clarence Van Sickle. 518 pp. Published by McGraw-Hill Book Co., New York and London. Price $4.

Accurate cost keeping is a problem that confronts many engineers and contractors. The value of this book to them as compared with general works on accounting is that its major emphasis is placed on those elements of the accepted systems of accounting that are of special interest to contractors or to engineers engaged in construction or in manufacturing. The book formerly published under the title "Cost Finding for Engineers" was prepared primarily as a textbook for students, but will be found helpful for the man in the field who went to school before it was thought necessary to teach engineers how to keep accounts.

Structural Design Aid

STRUCTURAL BENDING MOMENTS SIMPLIFIED—By Ulrik T. Berg. 186 pp. Published by the author, 7200 Ridge Boulevard, Brooklyn, N. Y. Price $4.50.

The purpose of the book as stated by the author in the preface is "to provide the civil and structural engineer with a tool for the practical, quick, and yet accurate solution of statically indeterminate structures." The field covered includes continuous beams, rigid and arch frames, and quadrangular structures. Both constant and variable moments of inertia are considered.

The method mostly followed is that of "fixed points." An effort is made to modernize their application. Instead of the graphical procedure devised by Prof. Ritter, the author arrives at his results analytically. Unfamiliar terms as "fixed-point coefficients," "adjusted rigidity," "directed continuity," "unit method," are used. The tables and formulas include about every case in ordinary practice of steel and concrete construction. A prodigious amount of work must have been involved in their preparation. The 75 examples of the final chapter illustrate application to a wide range of structures. It may be noted that the chapters on arched frames are independent of fixed points; also that the solutions for quadrangular frames as well as many methods throughout the book are quite original.—*Reviewed by* ROBINS FLEMING, *American Bridge Co., New York.*

Scientific Data

VAN NOSTRAND'S SCIENTIFIC ENCYCLOPEDIA—1,234 pp. Published by D. Van Nostrand Co., New York. Price $10.

Those who want concise data on scientific subjects outside their own field will find it in convenient form in this new encyclopedia. The principal emphasis is on the sciences, but an effort has been made to include terms used in civil, electrical and mechanical engineering. As is the case with all books of this kind, the specialist will not find terms in his own field that he thinks should be included and will be inclined to question didactic statements where the authors have gone beyond simple definitions. However, these are minor deficiencies which can be eliminated in subsequent editions. Especially valuable is the printing of words in the text of definitions in bold face when such words can be found defined elsewhere in the book.

International Railways

THE RAILWAY INTERRELATIONS OF THE UNITED STATES AND CANADA—By William J. Wilgus. 304 pp., folding maps. Published by Yale University Press, New Haven, and The Ryerson Press, Toronto. Price $3.

Across no other international border do trains move so frequently and with such an absence of red tape as those that cross the four-thousand mile line that separates Canada from the United States. At 55 points traffic moves over the border either on rail or on car ferries. Back of this record of free interchange is an interesting history that never before has been put together in concise and readable form. It has been done here by William J. Wilgus for the Carnegie Endowment for International Peace as one of its Canadian-American Relations Series.

The book covers the development and construction of the gateway lines, giving enough of the physiography of the border region to demonstrate their significance, describes the gateways and important bridges and tunnels, outlines the investment and income and reviews the many factors affecting the rate structure. Railroad men and the many railroad fans on both sides of the border will read the book with much interest.

How Federal Aid Works

THE ADMINISTRATION OF FEDERAL GRANTS TO STATES—By V. O. Key, Jr. 388 pp. Published as the first of a series on studies in administration by Public Administration Service, 850 E. 58th St., Chicago, for the committee on public administration of the Social Science Research Council. Price, $3.75.

How federal aid works was learned by Dr. Key by visits to 25 states and talks with scores of state and local officials as well as important men in the federal bureaus. In this book he presents a vivid recital of the devices which have been evolved to lubricate federal-state relationships; things that work and those that do not. Strengths and weaknesses are suggested as well as future scope and limitations. Audits, standards, personnel and organization, inspections, budget review and allocation of costs are covered. As this book is the first of its type in a decade in which grants-in-aid to states and cities have increased to $770,000,000 annually it should be a valuable addition to the library of those who must administer such projects.

Reinforced Concrete

DIE STATIC IM EISENBETONBAU—By Kurt Beyer. 2 Volumes; pp. 804. Published by Julius Springer, Berlin, Germany. Price 62.50 R.M.

The first volume of this remarkable German work opens with a discussion of fundamentals such as earth and hydraulic pressures. Following are chapters on statically determinate structures under various conditions and a very technical treatment of statically indeterminate structures. An outstanding chapter is on the design of tunnels under various unsymmetrical loadings. Sev-

eral methods are given for solving stress problems in which the unknowns are many. The closing chapter deals with the design of a structure by the elimination of the shear forces, taking into account restraint, deformation and displacement.

The second volume is even more theoretical. It includes beams on statically indeterminate supports, double frames with vertical or sloping supporting members. The treatment of arches deals with stresses for temperature, deflections, etc. Rectangular and circular slabs are given a thorough theoretical treatment with special reference to foundations in which the soil pressure is not constant.—*Reviewed by* ODD ALBERT, *East Orange, N. J.*

Dynamics of Flow

HYDRO AND AERO-DYNAMICS—By S. L. Green, 163 pp. Published by Sir Isaac Pitman & Sons, London, and Pitman Publishing Co., New York. Price $3.50.

This book covers fully, but in much condensed form, the mathematics of the flow of the "ideal fluid." Commencing with the equations of motion, the author proceeds to continuous motion in two dimensions, through the medium of the complex variable, and treats of sources and sinks, doublets and images. He treats of conformal transformations, with application to a source and a doublet, and then proceeds to the mathematics of discontinuous motion in two dimensions. Chapter IV treats of the flow and circulation, simply and multiply connected areas, Green's Theorem and Cauchy's Theorem. Chapter V develops two-dimensional flow about a circular cylinder, leading up to the Kutta-Joukowski Theorem for the flow about an airplane wing.

Chapter VI deals with vortex motion, images, the path of a vortex in a quadrant, Karman's vortex street, vortex sheets and discontinuous velocity; Chapter VII with the mathematics of surface waves; and Chapter VIII with motion in general, leading up to the flow about a body of airship form.

Chapter IX deals with the motion of a viscous fluid and laminar flow, ending with a definition of Reynolds Number. Chapter X treats briefly of the flow in the boundary layer, and Blasius' solution for flow past a flat plate, and ends with six pages on turbulence, as far as Prandtl's seventh power law. There is no mention of more recent developments that are proceeding rapidly at the present time.

The book deals strictly with the mathematics of fluid flows, and presupposes a considerable knowledge of mathematics. Most of the chapters end with numerous examples. The book is valuable as a short text book, and also contains much information to constitute a handbook for persons who are familiar with the subject.—*Reviewed by* W. WATTERS PAGON, *Consulting Engineer, Baltimore, Md.*

MISCELLANEOUS NOTES ON BOOKLETS AND REPRINTS

THE 30-YEAR DECLINE IN COMMODITY PRICES is the subject of a pamphlet published by the Eddy-Rucker-Nickels Co., Harvard Square, Cambridge, Mass. Price, 25 cents.

MAGNITUDE AND FREQUENCY OF FLOODS on Illinois Streams, Bulletin No. 296, Engineering Experiment Station, University of Illinois, Urbana, Ill. Price, 70 cents.

SNOW CONTROL BY TREE PLANTING, a paper prepared by the Michigan Engineering Experiment Station, in cooperation with the Highway Research Board, has been published by the Station as Bulletin No. 75. Price, 50c. East Lansing, Mich.

BOOKS relating to the conservation of natural resources are listed in a pamphlet entitled "Concerning our Natural Resources," published by the American Association for the Advancement of Science, Smithsonian Institution Building, Washington, D. C.

STUDIES IN ROAD FRICTION, PART 2, An Analysis of the Factors Affecting Measurement, a report of the Department of Scientific and Industrial Research and of the Ministry of Transport, Great Britain, published as Road Research Technical Paper No. 2, is obtainable from H. M. Stationery Office, London, England. Price, 1 shilling.

PAPERS PRESENTED at the symposium on correlation between accelerated laboratory tests and service tests on protective and decorative coatings held during the fortieth annual meeting of the American Society for Testing Materials in June, 1937, have been published in pamphlet form by the society, 260 So. Broad St., Philadelphia. Price 60c.

A TROUBLE CHART FOR DIESEL ENGINES has been published by the Norman W. Henley Publishing Co., New York. Price 50c.

UNIT HISTORICAL COSTS of electric distribution property is the subject of a small pamphlet published by E. F. Miner, Arlington, Va., that sells for $2.

WATER SUPPLIES OF ILLINOIS are summarized in a pamphlet entitled "Illinois Public Water Supplies" published by the Department of Health, Springfield, Ill.

WILLIAM WESTON'S "Contributions to Early American Engineering" has been made the subject of Serial 26, School of Engineering, Yale University, New Haven, Conn.

REVISIONS OF THE BUILDING CODE of Chicago made by the city council last fall have been assembled by the Municipal Reference Library, City Hall, Chicago, in a pamphlet which sells for 35c, plus 5c. postage.

SPREADING WATER FOR STORAGE UNDERGROUND is the subject of Technical Bulletin No. 578, U. S. Department of Agriculture. Copies may be obtained from the Superintendent of Documents, Washington, D. C., price, 15c.

A NEW BIBLIOGRAPHY of books relating to highway or motor transportation has been published by the National Highway Users Conference, Washington, D. C., under the title of "Highways and Motor Transportation—A Bibliography." Copies may be obtained from the Conference headquarters.

FAILURE OF CONGRESS to approve the interstate compacts for flood contral drawn up by the New England States after it had made provisions for such compacts in the Flood Control Act of 1936 gives special interest to "Report on Interstate Compacts for Flood Control" prepared and published by the Water Resources Board, Concord, N. H. The booklet tells how the New England compacts were drafted under urgings of federal officials and denies in

moderate terms the charge that federal policy as laid down in the Flood Control Act and in the federal Water Power Act was violated by the compacts. The historic place of the New England controversy, in view of the attempt at forcible federalization of state rights and powers, gives the present document special claim to attention.

FORMULAS AND TABLES for the Transformation of Geodetic to Plane Coordinates on the Lambert and Transverse Mercator Projections have been published in pamphlet form by the U. S. Geological Survey, Washington, D. C. Price, 5 cents. The pamphlet presents a method by which it is possible to obtain from the geodetic coordinates at any point the plane rectangular coordinates of that point as referred to the standard state plane coordinate systems. The computation is arranged for use on any one of several calculating machines now on the market.

CAVITY WALL SPECIFICATIONS and design details have been published in a pamphlet prepared by the Brick Manufacturers Association of New York, Grand Central Terminal, New York City.

NEW PUBLICATIONS

URBAN BLIGHT AND SLUMS By Mabel L. Walker. 442 pp. Published by the Harvard University Press, Cambridge, Mass. Price $4.

SOME METHODS FOR THE DETECTION AND ESTIMATION OF POISONOUS GASES AND VAPORS IN THE AIR—By A. S. Zhitkova. Translated from Russian by Joseph B. Ficklen. 198 pp. Published by Service to Industry, Box 133, West Hartford, Conn. Price $3.

RAFT FOUNDATIONS—The Soil-Line Method of Design with Worked Examples—By A. L. L. Baker. 82 pp. Published by Concrete Publications, Ltd., Westminster, England. Obtainable from the Engineer's Bookshop, New York. Price $2.

ESSENTIALS OF ENGINEERING MATHEMATICS—By J. P. Ballantine. 578 pp. Published by Prentice-Hall, Inc., New York. Price $3.75.

BOULDER CANYON PROJECT, FINAL REPORTS—Part VI—Hydraulic Investigations: Bulletin 1, Model Studies of Spillways; Bulletin 2, Model Studies of Penstocks and Outlet Works. 190 and 165 pp., respectively. Prepared and published by the Bureau of Reclamation, Customhouse, Denver, Colo. Price in U.S.A., each, $1.00 (paper) $1.50 (cloth).

TRANSPORTATION ON THE WESTERN FRONT-1914-1918—Official History of the War (British). Compiled by Col. A. M. Henniker. 531 pp.; separate case of maps. Published by His Majesty's Stationery Office, London; obtainable from British Library of Information, 270 Madison Ave., New York. Price $5.50.

MASTER BUILDERS OF SIXTY CENTURIES—By John Anderson Miller. 315 pp. Published by D. Appleton-Century Co., New York and London. Price $3.

PUBLIC UTILITY RATE MAKING AND THE PRICE LEVEL—By E. M. Bernstein. 142 pp. Published by the University of North Carolina Press, Chapel Hill, N. Y. Price $2.50.

THE MIDDLESEX CANAL—1793-1860—By Christopher Roberts. 252 pp. Published by the Harvard University Press, Cambridge, Mass. Price $3.

BEMESSUNGSVERFAHREN — By B. Löser. 215 pp. Published by Wilhelm Ernst & Sohn, Berlin, W9. Price 6.30 RM.

BEWEGUNGSFUGEN IM BETON UND EISENBETONBAU—By A. Kleinlogel. 215 pp. Published by Wilhelm Ernst & Sohn, Berlin, W9. Price 12.40 RM.

ECONOMICS OF HIGHWAY PLANNING—1937—By C. B. McCullough and John Beakey. 484 pp. Published by the Oregon State Highway Commission, Salem, Ore. Price on application.

LE RETI IDRAULICHE—Bonifiche-Fognature Torrenti E Fiumi—By Giulio Supino. 390 pp. Published by Nicola Zanichelli, Bologna, Italy. Price 75 lire (paper cover).

HEATING, VENTILATING, AIR CONDITIONING GUIDE-1938—Vol. 16. 1188 pp. Prepared and published by the American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York. Price $5.

TRANSPORTATION ON THE GREAT LAKES—Transportation Series No. 1 (Revised 1937) 441 pp. Prepared by the Board of Engineers for Rivers and Harbors. Obtainable from the Superintendent of Documents, Washington, D. C. Price $1.75 (paper cover).

THE GOLDEN GATE BRIDGE—Report of the Chief Engineer to the Board of Direction of the Golden Gate Bridge & Highway District. 246 pp. Published by The Golden Gate Bridge and Highway District, San Francisco. Price $6, limited edition.

MANUAL FOR WATER WORKS OPERATORS—Prepared by Texas Water Works Short School, L. A. Quigley, Manual Committee Chairman; E. W. Steel, editor in chief. 278 pp. Distributed by Texas State Department of Health, Austin, Tex. Price on application.

MATERIALS AND STRUCTURES—Vol. II-The Theory and Design of Structures—By E. H. Salmon. 796 pp. Published by Longmans Green & Co., London, New York, & Toronto. Price $12.

ENGINEERS' COUNCIL FOR PROFESSIONAL DEVELOPMENT: FIFTH ANNUAL REPORT—32 pp. Published by the Council, 29 W. 39th St., New York.

COMMUNITY IMPROVEMENT APPRAISAL-New York City—By Mayor Fiorello H. LaGuardia. 103 pp. Published by U. S. Works Progress Administration, 70 Columbus Ave., New York.

GRAPHIC ROUTES TO GREATER PROFITS—by John W. Esterline. 319 pp. Published by the Esterline-Angus Co., Indianapolis, Ind. Price $3.

WOOD TRUSSES-STRESS COEFFICIENTS & ANGLES—Wood structural Design Data, Supplement No. 5. 48 pp. Published by the National Lumber Manufacturers Association, 1337 Connecticut Ave., Washington, D. C.

RECORDS OF WELLS IN NASSAU COUNTY, N. Y.—Prepared by the U. S. Geological Survey in cooperation with the Water Power and Control Commission and with Nassau County. 139 pp. Published as Bulletin GW-5 by the Water Power and Control Commission of the State of New York, Albany.

A TECHNICAL REVIEW OF THE NORRIS PROJECT—75 pp. Obtainable from the Information Office, Tennessee Valley Authority, Knoxville, Tenn. Price $1.

SPRINKLE'S CONVERSION FORMULAS—By Leland W. Sprinkle. 122 pp. Published by P. Blakiston's Son & Co., Inc., Philadelphia. Price $1.25

MANUAL OF ACCIDENT PREVENTION IN CONSTRUCTION—Second Revised Edition-1938. 372 pp. Published by the Associated General Contractors of America, 1227 Munsey Bldg., Washington, D. C. Price $2.

AIRPLANE STRUCTURES—Vol. I—Second Edition. By Alfred S. Niles and Joseph S. Newell. 451 pp. Published by John Wiley & Sons Inc., New York and Chapman & Hall, Ltd., London. Price $5.

PROBLEMS CREATED BY PREMATURE SUBDIVISION OF URBAN LANDS IN SELECTED METROPOLITAN DISTRICTS—By Philip H. Cornick. 346 pp. A report to the State Planning Council of New York. Published by Division of State Planning, Albany. Price $1. (paper cover).

THE WEEK'S EVENTS

(Continued from page 607)

Home Building Center Planned at Fair

The New York World's Fair Corp. has completed plans for a section of the 1939 fair to be devoted to materials and methods of home building. Outstanding elements in the exhibit will be a model community, "The Town of Tomorrow," which will occupy five of the ten acres devoted to the home building center. It will comprise at least 21 demonstration homes showing the use of various materials, equipment, and methods of construction and modernization.

In addition, a domestic utilities building will house a series of about ten residential basements. A home building products building will house manufacturers' displays, and another fair-built building will be devoted to a display of home furnishings and decorations and household utilities.

The model houses in the exhibit, ranging in cost from $3,000 to $17,000, will be partly financed by manufacturers of building materials and equipment and will be constructed by the fair corporation with its own forces.

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Philippine Works Program Concentrates on Roads

A bill has been prepared by the Philippine Department of Public Works and Communication covering a public works program involving the expenditure of $46,135,900 within the next few years, according to a report to the U. S. Department of Commerce.

A large portion of the money to be expended in the proposed program will be used for the construction of roads, including $13,600,000 for national roads, $4,900,000 for local roads, and $5,000,000 for surfacing existing national highways, the report stated.

In addition to the highway appropriations, there are also appropriations for roads around Manila which will be constructed in order to divert through traffic from the city streets. Appropriations are also proposed for the development of the north port of Manila Harbor which involves the building up of considerable land and the deepening of the harbor. The new land will be used partly for ports, for interisland ships and partly for tenement projects, it was reported.

The bill is now in the hands of the Public Works Committee of the Philippine National Assembly and local observers expect that the bill will be approved without substantial change.

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Engineers to Be Licensed On New York FHA

The New York State Division of the Federal Housing Administration has agreed to comply with the requirements of the New York State education law and will require that in the future supervisors and inspectors for the FHA in New York State will be registered architects or professional engineers. This was announced by the practice violation committee of the New York State Society of Professional Engineers after a conference with state director Grace of FHA.

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Damage Claim Entered For River Turbidity

Damage claims estimated at $150,000 to $200,000 were presented to the U. S. Engineers at hearings held in Fulton, N. Y. April 12. The claims arise from the turbid condition of the Oswego River which was said to have been caused by deepening work on the Oswego division of the New York State Barge Canal. It was asserted at the hearing that unless the condition of the river is improved, several manufacturing plants will be forced to close down. Two mills have installed settling tanks, but smaller concerns assert they cannot afford the cost.

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Coulee Contractors Buy Three Large Cranes

A $1,750,000 subcontract has been awarded by Consolidated Builders, Inc., Grand Coulee Dam contractors, to the Colby Steel & Engineering Co. at Seattle to furnish three cable cantilever cranes and to enlarge four other cranes for use on the dam. Fabrication and erection of the steel will be carried out by the Bethlehem Steel Co.

The new cranes are said to be among the largest and fastest ever built for construction work. They will lift 20 ton loads of concrete, and carry them along a trestle at a speed of 600 ft. a minute.

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

NATIONAL LIME ASSOCIATION, annual convention, Netherland-Plaza Hotel, Cincinnati, May 9-10.

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting, Chalfonte-Haddon Hall, Atlantic City, June 27-July 1.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, annual meeting, Texas A. & M. College, College Station, Texas, June 27-30.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, summer convention, Washington, D. C., June 20-24.

REGIONAL AND LOCAL

MARYLAND-DELAWARE WATER AND SEWERAGE ASSOCIATION, annual conference, Emerson Hotel, Baltimore, May 19-20.

SECTION MEETINGS, American Water Works Association:
Pacific Northwest, Spokane, May 19-21.

ELECTIONS AND ACTIVITIES

THE SASKATCHEWAN branch of the Engineering Institute of Canada elected Prof. I. M. Fraser president at its annual meeting. J. McD. Patton was elected vice-chairman.

A BELLINGHAM CHAPTER of the Washington Society of Professional Engineers has been organized, succeeding the Whatcom County Association of Professional Engineers. Fred McElmon has been elected president; Clarence D. Olds, vice-president; Edward W. Gooch, secretary-treasurer; and B. W. Huntoon, state board trustee.

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Hearings to Be Held On Pontoon Bridge

A public hearing on the application of the Washington state highway department to build a concrete pontoon bridge across Lake Washington between Seattle and Mercer Island will be held in Seattle May 4 by the U. S. Engineers.

The present plans for the bridge provide for overhead concrete and steel approaches extending 1,056 ft. from the Seattle shore and 1,027 ft. from the Mercer Island shore. The pontoon bridge proper will be 6,561 ft. long. Each approach will have a navigable span with horizontal clearance of 150 ft. and a vertical clearance of 30 ft. above the regulated level of the lake. The pontoon section will be provided with a navigation opening closed by a sliding connection, and providing a horizontal clearance of 200 ft.

OBITUARY

AUGUSTUS J. CALKINS, Boston contractor, died there April 15 at the age of 34.

FRANK F. SINKS, retired Seattle consulting engineer, died in that city April 14 at the age of 64. Sinks was a graduate of Rose Polytechnic Institute in 1896. For some years thereafter he served as assistant engineer for various middlewestern railroads and in 1901 he became principal assistant to T. L. Condron, Chicago consulting engineer. Five years later, Sinks became a member of the firm of Condron & Sinks and in 1911 he went to Seattle.

HARRINGTON TAYLOR, superintendent of construction for the Puget Construction Co. of Seattle, was drowned April 9 at the age of 29 in the Spokane River near Spokane while running a transmission line across the river for Inland Empire Rural Electrification, Inc. Taylor had been with the Puget Co. for 15 years.

JOSIAH R. JOHNSTON, assistant city engineer of St. Paul, died there recently at the age of 49. Johnston graduated in 1913 from Iowa State College. After several years with a number of Minnesota counties, he joined the army in 1917, rising from the rank of student engineer officer to captain of engineers. In 1919 he became engineer of Lyon County, Minn., and in 1923, after a year with the engineering firm of Toltz, King & Day, he joined the engineering force of the city of St. Paul as assistant superintendent of construction and repair. He became assistant city engineer in December, 1936.

WILLIAM J. ROBERTS, Tacoma consulting engineer and formerly engineer commissioner of Washington state highways, died April 6 in Tacoma at the age of 78. Roberts graduated from the University of Oregon in 1886 and from Massachusetts Institute of Technology in 1891. He served for three years as city engineer of Colfax, Wash., and then became assistant professor and later associate professor of civil engineering at the State College of Washington. He held his teaching post until 1908, at the same time engaging in consulting work on municipal sanitary and water supply problems. He continued his consulting practice for several years after leaving the college and in 1911 he became state highway commissioner of Washington. He left that position in 1913 to become consulting engineer of Kings county on its highway work and a year later he was appointed chief engineer of the flood control and improvement program on the White, Stuck and Puyallup rivers for the Joint Board of the Pierce and King County Commissioners. He held that position until 1923 when he returned to his consulting practice in Tacoma.

CAPT. WALTER H. ALLEN of the Navy Civil Engineer Corps, died April 19 in San Francisco at the age of 63. Capt. Allen graduated and did graduate study at Yale University and then served for several years on survey parties of the New York, New Haven & Hartford, the Mexican International Ry., and the Kansas City, Mexico & Orient Ry. In 1903 he joined the Naval Civil Engineer Corps. He would have retired from active service next February.

ERNEST C. MOORE, New York City consulting engineer and formerly connected with subway construction in the city, died April 18 at Smithtown Branch, Long Island, at the age of 67. Moore studied at Rensselaer Polytechnic Institute from 1886 to 1888 and worked briefly for a number of railroads in the South. He had his first connection with New York City transit as assistant engineer on the Third Ave. cable railroad from 1891 to 1893. He was resident engineer on the Lexington Ave. subway project and was engineer on a number of other city jobs. He had been practicing as a consultant for some years.

PERSONAL

CURTIS S. GARNER, general manager of erection of American Bridge Co., has been elected a director and vice-president. He will continue in full charge of erecting operations. Garner became connected with the American Bridge Co. in 1895 when he entered the employ of the Milwaukee Bridge & Iron Works which was later merged with American Bridge. He has had assignments in the engineering, operating and contracting departments of the company. He became assistant to the chief engineer of erection in 1901, manager of foreign erection in 1914, and general manager of erection in 1931.

C. L. STRAIT, assistant city engineer at Columbus, Ohio, has been promoted to the position of engineer in charge of sidewalks and surveys.

JESSE E. BUCHANAN has been made dean of the University of Idaho College of Engineering to succeed Ivan C. Crawford, who resigned a year ago. Buchanan is a graduate of the University of Idaho, class of 1927.

M. H. BRYANT, former engineer of Davis County, Iowa, has been named engineer of Appanoose County, to succeed the late G. E. Lusk.

COL. E. I. BROWN, division engineer for the U. S. Engineers at Richmond, Va., goes on leave May 1 prior to taking his retirement.

COL. JARVIS J. BAIN who was district engineer at Charleston for the U. S. Engineers will be made acting division engineer at Richmond, relieving Colonel Brown.

LT. COL. RAYMOND F. FOWLER, district engineer at Savannah, will have charge of the Charleston district, effective May 1, in adition to his duties at Savannah. The assignment is temporary until a successor to Colonel Bain is appointed.

HAL G. SOURS, former county engineer at Akron, Ohio, and more recently connected with the Truscon Steel Co. of Youngstown, has been named to the Ohio state board of registration for engineers and surveyors for a term ending in 1942.

J. H. THOMAS, who has been at the Salem, Ore. office of the WPA, has been named resident engineer for the WPA at Klamath Falls, Ore.

C. W. SINIFF, chief engineer for the Indiana state highway commission, has been made a member of the commission.

R. M. GILLIS, district highway engineer for the California division of highways at Fresno, has been advanced to the position of construction engineer of the division to succeed the late C. S. Pope.

HAL H. HALE resigned his position as city engineer of Knoxville, Tenn., last month after five years in that position and thirteen years service in the engineering department of the city. He has joined the engineering staff of the Tennessee Valley Authority.

CLARENCE M. BLAIR, INC. is the new name of the New Haven consulting firm of Blair & Marchant, Inc.

L. B. ELLIOTT has been appointed division engineer of the Illinois division of the Cleveland, Cincinnati, Chicago & St. Louis Ry.

GEORGE H. MINER has been appointed resident highway engineer for the Ohio state highway department in Medina County. He succeeds William R. Flagg, who resigned in 1936. Medina County work has been supervised by the division highway office at Medina since Flagg's resignation.